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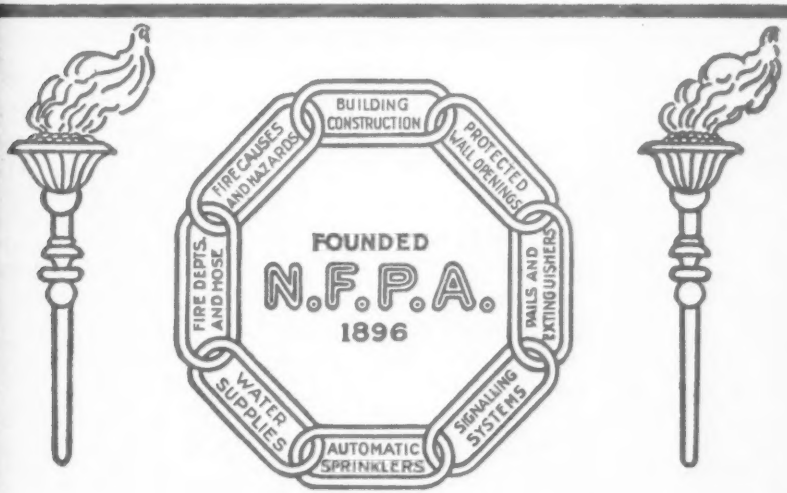
QUARTERLY
OF THE

NATIONAL FIRE PROTECTION ASSOCIATION

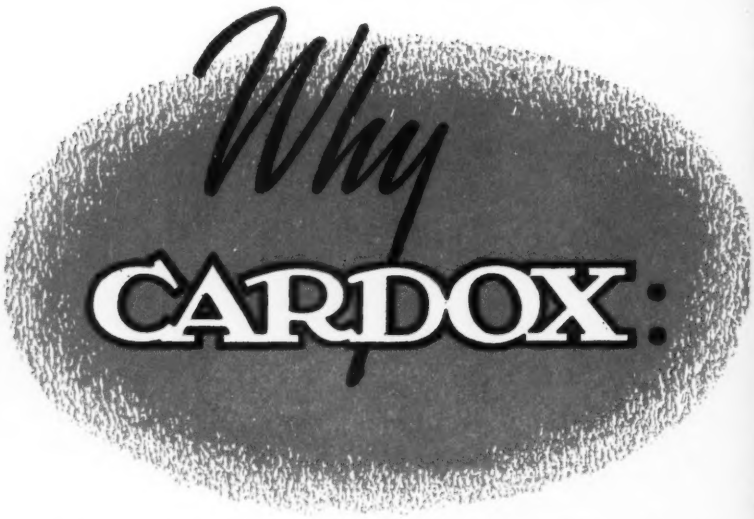


"To Promote the Science and Improve the Methods of Fire Protection and Prevention."

PUBLISHED QUARTERLY AT BOSTON, MASS., BY THE
NATIONAL FIRE PROTECTION ASSOCIATION

Printed in U. S. A.

OF ALL THE WAYS TO EXTINGUISH FIRES



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Vol. 35 April, 1942 No. 4

QUARTERLY

OF THE

National Fire Protection Association

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60 BATTERYMARCH STREET, BOSTON, MASS.

National Fire Protection Association

INTERNATIONAL

A NON-PROFIT TECHNICAL AND EDUCATIONAL ORGANIZATION

To promote the science and improve the methods of fire protection and prevention.

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Western Factory Insurance Association.
Western Sprinkled Risk Association.
Western Underwriters Association.
West Virginia Fire Underwriters' Association.
West Virginia Inspection Bureau.

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Reports of fires appearing in the Quarterly are copies of or extracts from written reports forwarded to the Association. This Association, as a body, is not responsible for the statements or opinions of any of its members.

Seattle Post Intelligencer.

Enemy bombers have not yet come to North America, but the steady toll of accidental fires gives a foretaste of the destruction that might be wrought by incendiary bombs upon our highly combustible shores. This fire in Seattle, February 24, 1942, started in a wharf warehouse where a gasoline-thinned preservative was applied to fishing nets. Newspapers reported the loss at $500,000.

The Quarterly

Vol. 35 April, 1942 No. 4

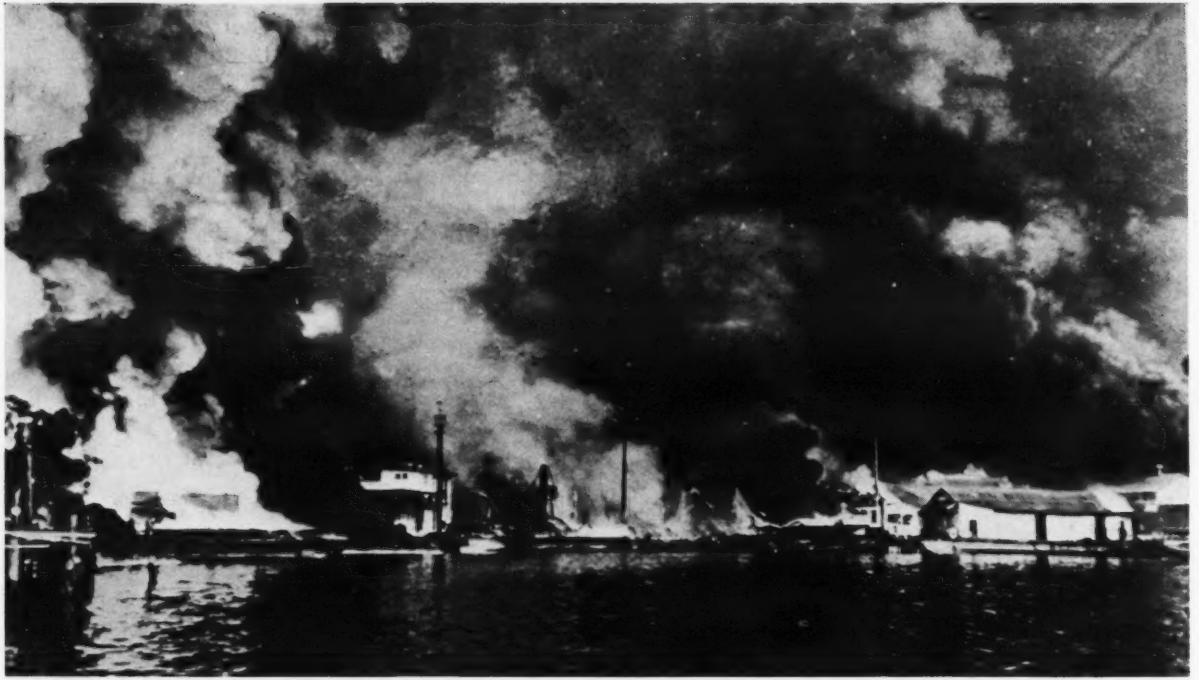
Speed with Fire Safety. The article by Curtis Pierce in this issue of the QUARTERLY is a forceful presentation of the great importance of maintenance of adequate measures for fire safety in all phases of the war effort, lest fire destroy our essential munitions of war and the facilities for their production. Men lacking experience in the fire field, intent upon speed in producing and making available the various munitions of war, are all too prone to be impatient of fire protection details that do not seem to them important, not realizing that uncontrolled fire can in a few hours nullify the results of months or years of effort, and destroy materials that cannot be replaced under present conditions. As President Roosevelt has said, "Time is of the essence." There is no more futile waste of time than through fires which might readily have been prevented or controlled in their incipiency by the exercise of reasonable forethought for fire safety. N.F.P.A. members throughout the country are in a position to exert a major influence for fire safety, and the most constructive war service that can be rendered by members as a group is for each to exert his individual influence for proper fire safety measures in every phase of the war effort with which he has contact.

* * * * *

Fire Safety in Defense Buildings. Mr. Lessing J. Rosenwald, Chief of the Bureau of Industrial Conservation, War Production Board, has been advocating the conservation of steel and other critical materials used in building construction by revising codes and specifications to provide higher design stresses for steel and generally reducing the use of critical materials. This policy, which is receiving considerable public support, should be carefully examined from the point of view of safety and fire protection.

Present standards for building construction features, as embodied in the promulgations of nationally recognized standardization organizations, may reasonably be assumed to specify the minimum use of material consistent with good practice and safety. If this is true it would not be possible to reduce the amount of material without sacrifice in safety or other essential factors.

In practically all engineering standards there is a factor of safety to take care of unknown or unanticipated contingencies. If the conditions of service can be exactly predetermined, the factor of safety may well be reduced. It does



U. S. Navy—International.

The Cavite Navy Yard, near Manila, after Japanese bombing on December 12, 1941. Only from the date line on the picture can we tell that this is not one of the accidental fires that are taking month-to-month toll of waterfront property, ships and their cargoes in American ports. The same factors of combustible construction and lack of protection invite wholesale destruction by fire, whether the cause be an incendiary bomb or a careless cigarette.

not appear, however, that conditions of service of structures can be predetermined in war time any more accurately than in ordinary times. In building construction standards, factors of safety are provided in the strength of materials primarily to take care of two uncertain factors—workmanship and loading. It is a well-known fact that the strength of completed structures depends to a considerable extent on the quality of the workmanship in their erection. There does not seem to be any likelihood of better quality of workmanship during the war than in ordinary times. As regards the load factor, buildings are designed for specified loads, but these loads may be exceeded in various ways, owing to changes from the original designed use of the structure and due to various other factors. The possibility of abnormal loading of structures likewise seems no less under war conditions than in peace time. A further factor to be considered in war time is the possibility of bomb attack and the consequent importance of full structural strength.

This leads to the suggestion that conservation in the use of iron, steel and other critical materials for building construction purposes might preferably be accomplished by the use of alternate types of construction, rather than by reducing standards. For example, concrete construction can be substituted for steel construction in many cases, and heavy timber may be used in place of unprotected steel members without increase in fire hazard.

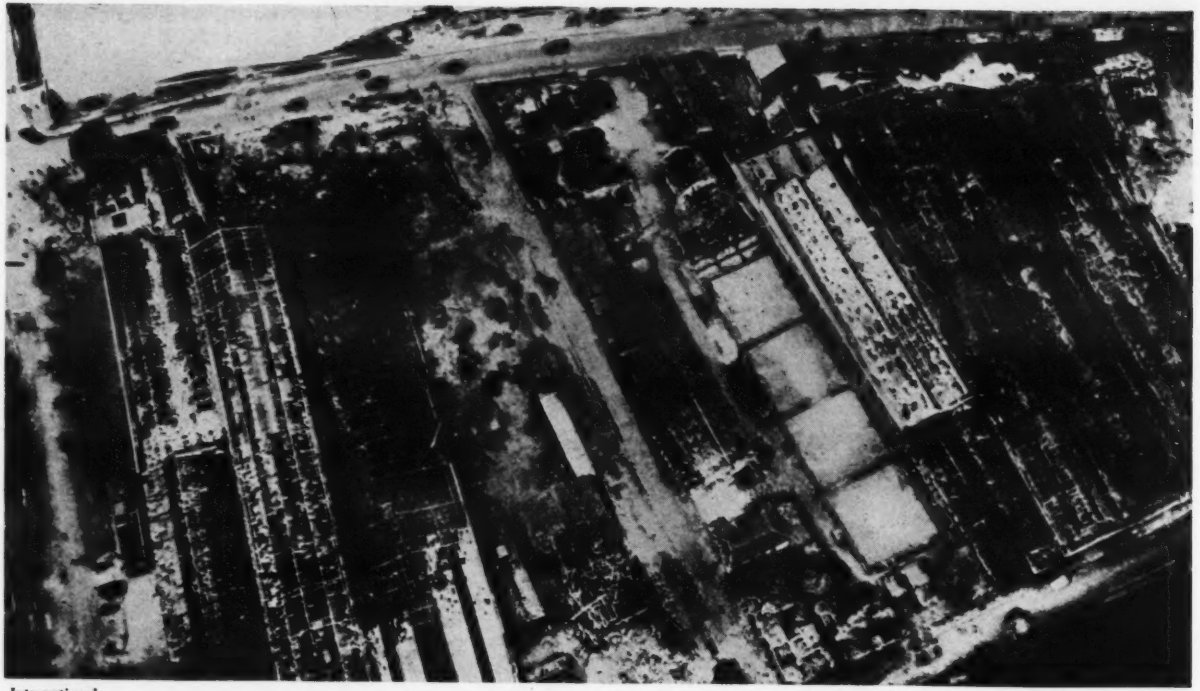
It is true that many local building codes specify the use of critical materials in excess of the requirements of nationally accepted standards, and in so far as this may result in unnecessary use of materials it would obviously be most appropriate to secure the modification of such local requirements to bring them into conformity with national standards.

* * * * *

Ersatz Hose. Cotton rubber-lined fire hose, as used in the United States and Canada, is a high grade product that has given an excellent account of itself under the hard usage of fire fighting service. Given reasonable maintenance, it lasts for a good many years, withstands high pressures, and seldom fails in service. This is due in large measure to the fact that hose has been made and tested to comply with the standards for cotton rubber-lined fire hose adopted by the N.F.P.A. and other national organizations.

Now the standard hose is no longer to be manufactured, and all hose must follow a new government specification. The rubber lining will be only about half the former thickness, a large proportion of reclaimed rubber will be used, and the old specifications will be modified in certain other details. The idea is that hose is needed in large quantities, while rubber is scarce, so firemen will have to get along without the "gold plated" product to which they have been accustomed. Firemen are just as ready to make sacrifices as any one else, as far as concerns their own comfort, convenience and personal safety. But they do not want to fail in their duty because of inferior equipment.

goes in American ports. The same factors of combustible construction and lack of protection invite wholesale destruction by fire, whether the cause be an incendiary bomb or a careless cigarette.



International.

Ruins of the Renault Motor Works, Paris, as seen from a British Royal Air Force plane after an R.A.F. raid. The picture shows the wreckage wrought by bombs and bomb-set fire, destroying the facilities for production of German airplane engines and other war supplies. War production concentrated in closely grouped, large area buildings provides easy target for bombers, and invites wholesale destruction by fire from any cause.

No one knows what the new hose will do. Tests on new samples do not tell what will happen in years of service. We hope the new hose will be a satisfactory emergency substitute, but we do not know. We do know that hose failures might lead to the destruction of cities, loss of life, and the burning of vital war supplies and manufacturing plants. We know that hose is essential to the public safety, but we cannot say whether quantity or quality is more important, whether it would be better to use the available material to make a thousand feet of standard hose under the time-tested specifications, or the same material to make two thousand feet of the new hose that we *hope* will be satisfactory.

We might even speculate as to whether it is proper to use any rubber at all for fire hose, whether the available rubber might better be used for tires and whether we should turn to some new type of fire hose that does not use any rubber at all. Some such hose is now used, and other types might well be developed that would be better than an inferior grade of cotton rubber-lined hose. There is already available unlined linen hose, and cotton hose with a special linen lining. Synthetic linings other than rubber might perhaps be used, or watertightness secured by some waterproofing treatment of the cotton hose itself. There seem to be many interesting opportunities for research that might be explored.

* * * * *

Hoarded Hose. Few, if any, city fire departments, no matter how well equipped for peace time fire fighting, consider that they have adequate reserve hose for war time fires. Hose has been a major factor in London's success in minimizing air raid damage. It has been used in huge quantity for relay pumping where water mains have been broken, and to bridge gaps in the water distribution system, thus maintaining water service in areas that would otherwise have been without domestic supplies, as well as for usual fire fighting. The British anticipated the emergency, and purchased quantities of American hose before the German blitz.

No such preparations have yet been made in the United States. The Civilian Defense program contemplates supplying hose and other equipment to vulnerable cities, but it will be a long time before our factories can produce millions of feet of hose. The hose, when available, will not be of peace time quality, and at best many cities will still feel that their hose reserves are not sufficient for air raid fire emergencies.

There are now hundreds of thousands if not millions of feet of hoarded fire hose in this country, hose that cannot conceivably be used in the places where it is, and which is of no use to anybody. This hose is not hoarded in the usual sense of the term, because it has been purchased and kept to meet the provisions of well-intentioned building codes, but the result is the same, as hose of no current use to its owners is thereby kept from use for the general public

welfare. We refer to the 2½-in. hose attached to building standpipes, particularly in fire-resistive buildings with little combustible contents, where it is difficult to conceive of the need of anything more than a 1½-in. hose line. The outstanding example is furnished by New York's fire-resistive office buildings. Even where the hazard is such as to call for 2½-in. hose lines, the presence of the hose is questionable. Occupants of the building, unless specially trained, are likely to injure themselves and others if they attempt the use of 2½-in. hose. Fire departments very seldom use the 2½-in. hose attached to standpipes, but carry in their own hose, for they have found by long experience that such private hose is often not properly maintained and is all too likely to fail at a crucial moment.

This suggests the desirability of a program, implemented by such local legislation as might be necessary, for removing unneeded 2½-in. hose from buildings and placing it in the hands of the fire department. Indiscriminate removal would obviously be undesirable, for there are some places where 2½-in. hose is definitely needed, but decision might be made on the basis of surveys of individual buildings, and the hose given to the fire department only where such action is approved by all concerned — the building management, the fire department and the underwriters.

Hose found on building standpipes is largely of the unlined linen type, which is not used by American fire departments. British fire departments have, however, been using unlined hose for years and the results have been satisfactory where hose has not had hard usage, and has been properly cared for. American fire departments could well keep such hose in reserve, not to be used for ordinary fire fighting, but available for emergency use in air raid fires. The procedure for the proper care of unlined linen hose is entirely different from that for rubber-lined hose, but there seems to be no good reason why American firemen cannot learn from British practice. The factors of greater friction loss and leakage could be allowed for in use.

It is probable that a certain proportion of hose removed from standpipes would be found to be unfit for use and would have to be discarded. Unlined linen hose should not be regularly tested with water, but uncertain hose could be so tested, and dried with extreme care before being put into reserve storage. It should be emphasized that this program would not involve any removal of 1½-in. standpipe hose, which is the proper size for use by ordinary occupants of buildings.

* * * * *

Even a Child. "Even a child can use **** to extinguish incendiary bombs. It is no more trouble than pouring sand out of a child's sand pail." — "The intense heat of the magnesium fire causes **** to form a vaporless layer of oxygen over the flame and smother it." These statements appear in a full page newspaper advertisement of a new extinguishing compound for

magnesium fires published by a large department store. We refrain from mentioning the name of the extinguishing material because it is a satisfactory extinguishing agent for magnesium fires, and we do not wish to reflect upon it by printing its name when quoting such ridiculous statements.

We feel that the public is being misled with respect to incendiary bomb fires. It is the fire started by the bomb that causes the damage, and the emphasis should be placed on extinguishing fires started by bombs. It would be fine if the bomb could be controlled before it starts a building fire, but we are advised that some incendiaries may explode and that we should stay away from them for the first minute or two, which is ample time for them to ignite near-by combustible materials. We do not minimize the value of extinguishing agents for incendiary bombs, but we deplore placing such emphasis upon them that attention is diverted from preparations for handling the fires started by the bombs.

As for the statements in the advertisement quoted above, we feel that children do not have the judgment to deal with incendiaries, even though they may be physically able to apply the extinguishing material. Even a child should know that a "layer of oxygen" does not extinguish. It is indeed unfortunate to confuse the public by such advertising statements.

* * * * *

The Normandie. We had hoped in this issue of the QUARTERLY to present a complete account of the burning of the steamship *Normandie,* renamed *Lafayette,* in New York on February 9. Unfortunately we are not able to do so because of war-time restrictions. We hope that eventually the official investigations will be completed and that the whole sad story can be made a matter of permanent record in the QUARTERLY. We feel that the lessons of this fire should be applied immediately, but we bow to authority.

Relationship of Safety to Production.

Speed, But Not Blind Speed.

C. W. Pierce, Manager,
National Bureau for Industrial Protection.

The automobilist who blindly drives at 90 miles an hour and disregards all safety signals usually fails to arrive at his planned destination.

A few weeks ago the *U. S. S. Lafayette*—better known as the *Normandie*—was being refitted for urgently needed war facilities at its pier in New York City. In the drive for speed, basic and elementary fire safety precautions were totally ignored! Direct result: a burned-out hull; loss to our war effort in terms of transport of men and material—inestimable; loss of property values, fifty millions of dollars—to be paid for by the people through the purchase of Defense Bonds and taxes. The public is asking the question, "What price blind speed?" Speed is essential, but the ultimate result of blind, frantic speed is waste, if not total loss.

Government officials, plant executives, and working men are bending every effort to better production terms of war contracts; terms which, in their very essence, call for speed and pressure on management, men, and machines. These abnormal conditions of emergency production develop abnormal, destructive perils which if not safeguarded are potential saboteurs of the nation's production effort.

The perils are fire, explosion, accident, and sabotage. Manufacturing facilities when reduced to ashes and twisted metal cannot produce, and in many cases cannot be replaced. Loss from these causes to our national war production of supplies and equipment can usually be charged directly to ignorance of the risks involved, carelessness or indifference, as disasters from these perils are largely preventable. Proper and practical safeguards which can be taken to eliminate or to reduce these hazards are well known to engineers who have specialized in plant protection and safety promotion work. They have been acid tested over the years in the laboratories of practical experience.

Importance of Safety in Planning.

These perils can be controlled, and the probability of their occurrence measurably reduced. The responsibility to see that all reasonable precautions are taken to assure continuing production of planes, ships, and equipment, the responsibility for safeguarding the nation's priceless supplies of critical and irreplaceable commodities, rests squarely upon the shoulders of those in direct charge of operations. Details may be handed over to subordinates, but not the responsibility. Furthermore the subordinate takes his cue from the boss. If the

boss by his attitude indicates that he does not take safety matters seriously, the subordinate cannot be expected to bear down on the job and produce results. The public has a vital interest in this matter and will demand that it be not neglected.

Ignorance of the existence and nature of these well-known dangers to the continuing production of our factories, to our shipyards, to our transportation systems, to the safety of our stock piles of essential critical commodities, and to our crowded piers and terminals will not be accepted by the public as an excuse for inaction or indifference to safety planning and preventive measures. The public will demand an explanation for failure to seek the advice and counsel of experts who have specialized in the specific fields of safety and fire protection engineering.

Let no one make the mistake of planning our war production in terms of appropriated billions which presuppose uninterrupted continuance of our facilities. RESULTS in finished guns, ships, and equipment must be counted only after they have rolled off the assembly lines and are delivered for actual service. Equipment cannot roll from a plant wrecked by fire, or sabotage. Ships cannot be launched from yards laid waste by explosions or other disasters.

The national interest demands and the public expects that all who share responsibility for the building of new plants, for production from established facilities of all kinds and for the storage and guarding of emergency stock piles recognize the direct and important relationship between the urgently necessary speed for output and expert fire and accident prevention. The certain result of recklessness, carelessness, and indifference to safety engineering is too high a price to pay for negligence during this emergency. The public is asking the question, "What price blind speed?" Interruptions can be avoided.

The fires that are occurring with increasing frequency in our defense plants can and must be reduced. The National Fire Protection Association, with Executive Offices in Boston, has recently issued an illustrated pamphlet of typical disastrous losses entitled "National Defense Fires." Mentioned are the total loss of a plant making one-third of our magnesium powder for bombs and tracers; the total loss of a plant making vital parts for airplane propellers, and the descriptive text laconically notes that the installation of a modern system of automatic sprinklers was "on order"; the nearly total loss of a plant manufacturing furnaces for army cantonments, which did not have the protection of automatic sprinklers; the total loss of a building under construction at an arsenal, destroyed as a result of failure to provide adequate safeguards. Illustrated among others is a fire burning ten thousand tons of valuable cork. Also the Association has compiled a list of 22 serious fires on pier properties, with losses of essential materials valued in the millions, all of which have occurred within the past ten months. Most if not all of these fires would not have started or gained headway had proper safety precautions been taken.

War Industries Board — 1918.

This was recognized in 1918 during the World War I. The President then accurately sensed the danger to our manufacturing facilities through inadequate fire and accident protection, with the result that the Chairman of the War Industrial Board established a Section to concentrate on the problem of losses with their resultant interruption of production. The work of this Section was directed by experienced executives of insurance companies and was staffed by the best expert engineers that they had available.

At the outset the reports made by the Section's engineers were sent to the Army, the Navy, and other bureaus interested. That system was soon changed in order to facilitate action. The Section's reports, with their recommendations, were sent directly to the plant or facility affected, the interested government departments being advised of all actions taken.

National Bureau — 1942.

In the present crisis the insurance industry again promptly stepped forward and offered to all branches of the Government the technical reports and services of its skilled engineers. Through the National Bureau for Industrial Protection, located in Washington, the Capital Stock and Mutual companies and Reciprocal associations are conducting regular inspections of manufacturing plants, stock piles of essential commodities, and certain other facilities. To date, over six thousand reports have been cleared through the National Bureau, and countless conferences have been held on related engineering subjects with Government agencies. As in World War I, this activity is managed and staffed by experts on the payroll of insurance companies. The work of the National Bureau is sponsored by the Insurance Committee for the Protection of American Industrial Plants, New York City.

In the Public Interest.

The insurance business is working with government agencies in a spirit of national service. It is keenly alive to the ever growing interest of the public in the prevention of unnecessary interruption to, and continuity of, our production program. It fully recognizes its responsibility to the public and to the government. It will continue to coöperate wholeheartedly with all government agencies and all private facilities when its experience can be of assistance to our supreme national effort.

"No Smoking."

It is needless to emphasize that any impediment, potential or actual, to America's maximum industrial production is of the most serious consequence in these critical times. The gravest threat of all is that of fire, and in this connection the problem of smoking in factories and industrial plants has recently been brought to the attention of the N.F.P.A. A number of inquiries concerning it have accordingly been made and the reports received from various parts of the country are of considerable interest.

In Detroit, last December, the army tank arsenal in one of the city's largest plants was temporarily closed because of a strike following workmen's complaints that they had been forbidden to smoke while on the job. A no-smoking rule had been in effect in the plant since its opening, and when foremen ordered all those who were smoking to leave the plant, a large number of the approximately 1500 men on the night shift departed in protest. Union stewards denied that there had been any authorization for a walkout. The company's statement read: "Thirty-eight employees were sent home shortly after midnight after they ignored repeated warnings against smoking on the job. Because of the fire hazard and the need for top production of tanks, there is a rule against smoking on the job. These men persisted in violating the rule."

Another report described a violation of no-smoking rules in a sprinklered printing establishment in an eastern city. "A slight fire developed (causing no loss under insurance) and it was determined that smoking on the part of several young men was the cause. It was found that the smoking could have been done by any one of four different young men, and as none of them would admit the identity of the offender, it was necessary for the management to dismiss all of them. It is interesting to note that this plant is highly unionized, as far as we know, and there were no repercussions from the union." A case parallel in certain circumstances, though not in its results, occurred in a large boiler shop in a city in the same state, when a strike was started over the right to smoke at work. The report reveals that five men had been laid off for smoking in the shop against the rules. In protest, all the workers began smoking and a week's lay-off ensued.

In one plant in the mid-West, a refreshment-cart concession was denied a union member on the ground that distribution of cigarettes and matches from the cart in certain sections of the building would constitute a decided fire hazard. No objection was raised to the concession, however, provided these particular articles were eliminated from the seller's wares. The union grievance committee, the group making the request, asked also that employees be granted permission to take five or ten minutes recess two or three times a day, and that

they be permitted in addition to smoke in various sections of the plant that were to be lined off, inasmuch as there was not enough space available for the desired smoking rooms. The president and the superintendent of the concern, together with the representative of an underwriting organization, agreed that lined-off areas would not be successful in solving the problem in this case. The final result was that all smoking was restricted to the plant's washrooms. The writer of this particular report, the underwriters' representative, concluded that "the president did not want to permit promiscuous smoking throughout the plant, but he needed the assistance of the insurance interests to help him in selling the union on the idea... So from this experience it would appear to me that many of these smoking cases could be eliminated, especially in small plants, if the insurance interests would support the executives of the plant... as was done in this case."

In several other plants in the country's industrial centers, employees have been discharged for their defiance of no-smoking regulations and manager-worker relations have thus become unnecessarily strained. One of the largest rubber manufacturing concerns in the country has revealed the problem to have been a continuing aggravation for more than two years. Obviously, both the fire hazard and the labor difficulty involved in the observance of no-smoking regulations are deserving of serious consideration by employers and labor leaders.

The most effective answer that has been found to date seems to lie in prescribing, *by mutual agreement*, certain restricted, safe areas within industrial plants in which smoking is permissible. In some foundries and metal-working shops, for example, smoking may represent so relatively insignificant a hazard that restrictions upon it may be reasonably relaxed. In designating safe smoking areas within a plant, it is desirable that the services of an insurance engineer or fire department inspector be enlisted. In almost every plant, such locations as company lunchrooms or recreation halls can be labeled safe areas if under careful supervision and provided with ash trays, metal waste receptacles, and signs indicating the proper disposal of cigarette stubs and matches. One correspondent, representing a factory insurance organization, states: "It is our contention that if designated places, properly safeguarded, are open to the employees, the promiscuous smokers will soon fall in line with little prompting. Smoking, of course, has to be positively prohibited in many parts of certain plants, and in some cases even the entire plant may come in that category, due largely to the nature of the material used." Alternatives to this appear in the policy of the Eastman Kodak Company, which forbids the carrying of matches by employees, and in the New York State prohibition of all smoking in factories except by special permission of the State labor department.

It is quite certain that in many plants any blanket restriction on smoking would defeat entirely the purpose of regulation. It would be likely to have

unfortunate effects on personnel discipline and would undoubtedly encourage such abuses as leaving the job to take a smoke, outright defiance of the restriction while on the job, or open show of resentment toward superintendents and managers, any one of which actions might result in a serious slowing up of production or an actual strike. Only a reasonable restriction has any chance of success, but once set and understood it must be enforced without question. The best way for any worker to keep his job is to keep that job safe. It hardly seems necessary to point out that the personal safety of every individual and the speeding up of the country's wartime effort are the vital factors involved.

A large metropolitan daily recently reported that one worker, caught as a third offender smoking a cigar in a war plant where he was employed as a cutter on army uniforms, was fined $150 by the city magistrate. On announcing that he was unable to pay the fine, he was sentenced to sixty days in jail. Fourteen other men were fined $25 each for smoking in defense plants and three youths $10 apiece. The magistrate took pains to emphasize his belief, however, that some of the blame for such violation of fire regulations lies decidedly with the employer.

The N.F.P.A. wrote not long ago to the heads of both the American Federation of Labor and the Congress of Industrial Organizations, soliciting their coöperation in this matter of workers' observation of fire safety rules. The reply of Mr. William Green, president of the A. F. of L., is notable for its emphasis. "I know of no instance where American Federation of Labor organizations have resisted any efforts whatever to prohibit smoking in factories in order to prevent fires and to reduce fire hazards. On the contrary it is my opinion that labor unions coöperate fully in any movements launched for the purpose of reducing fire hazards. *This is a course which I would strongly advise be followed.*"

The C. I. O. response reads in part: "We here have had no reports of complaints concerning the prohibition of smoking. I am sure that where smoking would constitute a fire hazard because of materials or chemicals used in production, our people would be glad to coöperate in the stopping of this practice inside of the factory, limiting smoking to rest periods on the outside."

Clearly, the wholehearted support of labor and the unceasing alertness of management are essential if the fire hazard now present in industrial plants and threatening the success of the nation's war production program is to be completely eliminated.

A.R.P. Plans for Special Occupancies.

Among the many critical problems facing defense authorities today is that of air raid precautions and fire protection for such occupancies as hospitals, department stores, and office buildings. These occupancies present special problems because of their size and extent and because large numbers of persons may be concentrated within them at a time of emergency. Since our large coastal cities, many of them already designated as "target areas" by military authorities, are more vulnerable to enemy air attack than those farther inland, their problem in this regard is unusually acute. The N.F.P.A., in recent weeks has discussed the matter in detail with officials in various parts of the country. Of the protection plans established or in process of organization in every state, those prepared for certain special occupancies in Seattle, New York, and Boston have been selected and are presented here as typical examples of what has been and what may be done in this connection. The U. S. Office of Civilian Defense has prepared extensive material of this subject, and has given consideration to the problems of special occupancies. The O.C.D. publications should be consulted by all those formulating A.R.P. plans.

Protection of Hospitals — Seattle.

Immediately following the outbreak of war on December 7, 1941, Captain Stephen E. Sanislo (member N.F.P.A.), Safety Education Director of the Seattle Fire Department, was ordered to make a complete survey of all hospitals, places of detention, jails, and homes housing children and the aged. His investigation revealed no plans of any kind for air raid defense. This was not surprising, for before Pearl Harbor few, if any, American cities had been spurred to such protective action.

Unfortunately, as in so many cities, not all hospitals in the Seattle area are of fire-resistive construction and this gave the investigators great concern. Although all of the institutions, large and small, had made elaborate preparations for the reception and care of bombing and fire casualties brought in from outside, none had given thought to the fact that the hospital itself might be bombed, its water supply interrupted, its sources of light and heat cut off, and its food and surgical instruments contaminated. Fire drills had been practiced more or less regularly, but the general safety of staff and patients had been given insufficient consideration.

Knowing the roof to be the most vulnerable section of any structure in event of an incendiary bombing attack, the investigators turned their first attention in each instance to its construction. Three elements were stressed in the examination: (a) the nature of the roof construction as a whole and the location of skylights, domes, and other such penetration points, (b) the pro-

tection of areas immediately beneath such points, (c) the protection of vents, elevator penthouses, and cornice coverings. Where a roof was found to be of concrete and at least 5 inches in thickness, its strength was deemed sufficient to resist penetration by the 1-kilogram type incendiary bomb. It was recognized, however, that scabbing might permit the molten magnesium or thermite to drip through to the ceiling below, unless proper safeguards were made. In cases where no damage to the roof was likely, the shoveling of bombs from its surface to carefully designated spots on the ground below was recommended.

The survey next revealed the need for rigid enforcement of city ordinances requiring that all stairways, hallways, and passageways leading to doors and other means of egress be adequately lighted by artificial (electric) light during *all* hours of darkness, including blackouts, and that required exit signs and red lights indicating the locations of emergency exits, including fire escapes, also be kept burning during *all* hours of darkness. The National Fire Protection Association's Building Exits Code was referred to in every such case, with especial emphasis being placed upon its provisions respecting careful housekeeping in hospitals, sanitariums, and corrective institutions, the importance of unobstructed passageways and exits, the vital need for unlocked windows and doors and for regularly practiced exit drills.

Since the training of hospital personnel is as important as structural safeguards, a meeting of the institution staff, executives, nurses, and other attendants, was held after the completion of each survey. Emergency duties were assigned each individual and thorough instruction given. All were drilled at length in ways and means of controlling incendiary bombs and the fires resulting from them. Roof watchers and fire fighters were designated and necessary extinguishing equipment installed at convenient points. All of the hospitals in the city have equipped themselves with additional fire-fighting appliances, chiefly in the form of 5-gallon pump tanks, axes, and ladders. Some institutions have provided themselves with new garbage cans, these to be kept filled with water at all times, either for fire-fighting or drinking purposes should the regular supply be interrupted. All hospitals have been reminded to provide auxiliary means of providing light and heat, replenishing contaminated foodstuffs, and sterilizing essential instruments. Considerable care has been taken to assure effective automatic transmission of alarms, in the event that telephone service should be unavailable. Though the fire department may not be able, because of other calls, to respond promptly, the call for aid will have at least been received and recorded, to be answered when possible.

Full responsibility for each institution's air raid precautions and fire safety has been placed upon the superintendent. It has been recommended that he delegate his authority to a dependable, experienced subordinate on each floor of the institution, and that reliable means of communication be established and maintained between floors and between each floor station and roof

watchers. Upon receipt of an air raid warning, nurses in each ward have been instructed to pull down the shades in all rooms occupied by patients, push beds as far away from windows as possible, and shield each patient's face with a pillow in order that injury from glass fragmentation may be minimized. Windows are to be blacked out in each hospital at such points as the respective superintendents judge best. Trial blackouts have indicated very satisfactory results in this regard.

Because of the evident difficulties involved in attempting exit drills on a complete scale, individual floor drills have been substituted in which both staff and patients have coöperated fully. That patients realized the seriousness of the drills was indicated in a recent blackout when almost no calls for room service were made during the period of darkness. In such drills, and as a general fire protection measure, the help of those air raid wardens in whose district each hospital is located has been solicited. In one case a group of young men from a near-by Y.M.C.A. have joined the hospital's air raid and fire brigade and are available for instant duty whenever summoned.

In the opinion of Chief Fitzgerald and Captain Sanislo of the Seattle Fire Department, no protection plan can be labeled adequate which does not include consideration of the following:

1. Type of building construction.
2. Height of building.
3. Classification of hospital care given.
4. Number of nurses on duty at all times.
5. Number of employees on duty at all times.
6. Type, number, and location of exits.
7. Means of inter-hospital communication.
8. Storage of flammable gases and X-ray film.
9. Private fire protection and its coördination with the public fire service.
10. Plan of evacuation, either partial or total.

Department Store Safety — Boston.

Of the several large department stores in the city of Boston, Wm. Filene's Sons Company seems at the present time the best prepared from both an air raid precautions and a fire protection standpoint. It is clear that such a location, with concentrated groups of employees and patrons present during all daylight hours and occasionally at night, represents a far greater hazard than do other parts of the city where population is more dispersed. The protection and evacuation of such massed groups of people obviously requires the most careful preparation.

As its initial preparatory step, Filene's has published a very clear and complete A.R.P. Warden's Manual, compact in size and excellently adapted for use among its employees. The manual's foreword states in part: "Organization for defense against enemy air raids is something new for us here at

Filene's...New techniques have had to be developed in combating the hazards of bombings, fire, explosion, and panic—and the last of these hazards is likely to be the greatest.

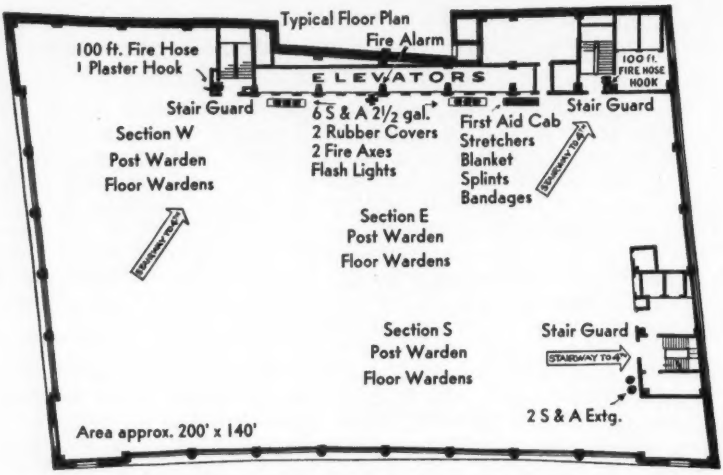
"In the last analysis our safety precautions will succeed or fail in direct ratio to the performance of *each individual* in each of our Safety Squadrons. Despite the use of every proven mechanical device, of every precautionary theory as developed by British experience, our success in A.R.P. will depend largely upon those individuals who have accepted the responsibility of membership in these squadrons. Our customers and fellow-employees will exhibit no more calm and control than we; they are likely to become just as excited and panic-stricken as we are. For this reason, not only by strict application to the duties assigned to us, but also by our example of prompt and businesslike obedience to orders will we achieve the results we have planned.

"Our Main and Gift Shop buildings are of first class construction. We are told on the best authority that they are as safe against fire and enemy raid as any place one could select in downtown Boston. In addition, plans and organization as outlined in this manual represent the latest and best methods for protection, based on actual experience. We are fortunate also in having a public address system which permits issuance of orders to every part of the premises. The rest of it is *up to you.* Learn your duties. Practice your assignments. Your leaders have been chosen because of known experience and ability; show your confidence in them by prompt and implicit compliance with their orders. KEEP COOL!"

Complete responsibility for Filene's A.R.P. personnel and organization rests with the Director of Safety. Reporting to him are the Chief Warden and his assistant, these being aided by Division Chiefs for Evacuation, Fire, Police, Engineering and First Aid. In order to avoid duplication of effort and to prevent dual responsibilities, the store's A.R.P. Service is integrated with that of the community as a whole. Its members are under the same discipline, wear similar distinctive insignia, and receive the same training under the supervision of local committees.

The Chief Warden, his assistant, and each of the Division Chiefs will use the building's Report Center as their headquarters in time of emergency. The location of this center has been made familiar to all employees and the numbers of all connecting telephones published. The functions and duties of the Chief Warden include the organization and training of all A.R.P. personnel, the careful and detailed preparation of the general A.R.P. premises under his control, executive command of all operations in event of air raid or other emergency, and representation of the store to the local defense committee and community report center, an assignment which includes keeping these agencies constantly informed of all incident, damage, or casualty suffered by or within the store.

The Evacuation Division includes the Evacuation Warden, a Traffic Chief and his assistant, Post Wardens, Floor Wardens, and Stairway and Entrance Guards. During an air raid speedy and orderly evacuation of customers



The thoroughness with which Wm. Filene's Sons Company of Boston has established its A.R.P. Service and fire protection is well illustrated by this typical floor plan, reproduced here from the store's A.R.P. Warden's Manual. Private fire protection, first aid, and evacuation procedure for any emergency have been provided for and each employee been made thoroughly familiar with them.

and employees to floors of buildings which afford maximum protection is of vital importance. A central section on each building floor has been declared a "safety area," and each warden on every floor has been provided with a chart of his particular floor, showing stairways and with directional arrows, in case of immediate evacuation, pointing to those stairways to be used in his respective area. Wardens in charge of evacuating will use the *one* phrase, "Walk to our Safety Area."

Post and Floor Wardens are responsible for the safekeeping of property, inspection and patrolling of premises once evacuation has been completed, to be sure all areas are cleared, and coöperation with Traffic Chiefs and Stairway Guards in directing and controlling the order of evacuation. The principal duty of the latter is to maintain calm and efficient evacuation of all groups and to guard all passageways against re-entrance by anyone until the "All Clear" has sounded. The function of the Entrance Guards is a parallel one, executed at all entrances and exits to and from the store. The adaptability of an organization of this type to peace-time fire drill operations is notable. Evacuation plans call for the movement of all groups to the nearest central points of safety within the buildings, that is, those affording a maximum of protection on all sides from demolition bombs and their fragmentation.

It is significant and important that the office and function of the Fire Chief has been kept distinct from that of the Chief Warden, thus avoiding

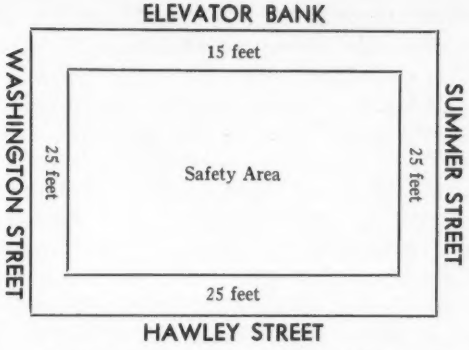


Diagram of the "safety area" which has been designated for A.R.P. use on each floor of Filene's department store, Boston.

confusion and overlapping of authority. Filene's Fire Chief has full charge at a fire; he recommends and purchases all new equipment; he is responsible for the maintenance, testing, and care of all fire apparatus and the disposal or readapting of obsolete and damaged equipment; he must see to the periodic inspection of the buildings for elimination of fire hazards; he must direct the instruction, training, and drill of the fire brigades, and maintain them in proper number and equipment at all times.

The Fire Chief is assisted by lieutenants assigned to each floor of every building and by fire floor captains, the latter being fully responsible for fire safety in their assigned areas. From 2 to 10 firemen have been stationed under the command of each captain. Filene's Manual, in listing the duties of these officers and firemen, discusses informatively the various types of fires and their extinguishment, together with the kinds of bombs now in war-time use and the best means of controlling them. Roof squads are to be maintained day and night for the detection and control of incendiary bombs falling on the roof, while the store fire brigade is charged with the duty of protecting all areas beneath it.

The A.R.P. Service is completed by the Police Division, which is responsible for the safeguarding of valuables and the maintenance of morale; the Engineering Division, assigned to the maintenance and supervision of utilities, rescue and salvage in event of bombing or fire, blackout operations, and the maintenance of an emergency resource list which is kept posted in the Report Center; and the First Aid Division, which has been trained and equipped to provide and administer emergency treatment to the injured from any cause. Each individual in each division has his respective duties clearly outlined in the A.R.P. Manual, so that no possible misunderstanding can arise.

Important to all employees is the general information which completes the Manual. This has to do with the operation and maintenance during emergency of sprinklers and other water supplies and of gas and electric mains. The function of all departments vital to A.R.P. communications, such as the time desk with its short wave radio, the telephone office, the Report Center, and the public address booth, is discussed briefly, but clearly. Although the duty of the individual is primary, his acquaintance with the general A.R.P. organization and operation will prove helpful both to him and to others. The thoroughness with which Wm. Filene's Sons Company has undertaken its preparation for emergency is illustrated by the fact that provision has been made even for morale groups, composed of talented staff members, to entertain evacuees and to help keep personnel spirits high in time of disaster.

Office Building A.R.P. — New York City.

Detailed air raid precautions plans for the Western Union Building at 60 Hudson Street, New York City, have been in existence for some time. Copies of the plans have been given a wide distribution among the company's general managers, superintendents, auditors, storekeepers, and other personnel. Intended as a guide for all Western Union occupancies, the plans stipulate first and foremost that the organization at all offices should function in a manner conforming to local regulations under the Civilian Defense Plan and shall be in working agreement with the local district or sector wardens having jurisdiction over the office location. Where an office is located in rented quarters and occupies only a portion of the building, the organization to function within the space occupied by the Western Union is to be in accordance with the program established by the entire building. If for any reason no program is arranged for the entire building, then the organization is to function along the lines indicated for a complete Building Control Unit of Western Union.

This Building Control Unit is one of three sections provided for emergency operation, its purpose being to deal with the effects of air raids so as to minimize disaster to personnel and property. The other two divisions are to provide for blackout operations and to assume maintenance and salvage responsibility where building changes and alterations occur. The Building Control Unit, under the supervision of a single director, includes an interior communication unit, floor wardens and monitors, roof watchers, power control groups, fire control and rescue squads, and first aid units.

The company's existing fire drill organization was used as a nucleus for forming the new Building Control Unit. The fire prevention committee has been made to function as part of the Building Control Unit and its members are "Directors" assisting the Building Control Director. These directors are assigned mainly to the care and supervision of personnel within the building, but they are to give further assistance with respect to blackouts, opening doors

and windows, reporting damage and personal injuries and performing such special assignments as may be necessary.

The chief responsibility of Floor Wardens, one of whom has been stationed on each floor of the building, is the safety and control of personnel. Each Warden is entrusted with the safety of all persons on his floor, whether they be regular occupants, visitors, tenants or those evacuated from other floors. For him and his assistants, known as Monitors, a specific but reasonably flexible procedure has been worked out for all emergency action. Among the "don't" instructions given emphasis is one directing that a Floor Warden shall not supervise the work of Fire Control, Rescue or First Aid Squads, but shall notify such workers of conditions requiring their services. Given positive stress is the direction that every Floor Warden shall select a reasonably safe position on his floor from which he can telephone urgent reports to the Building Control Director. Although the number of visitors to, or patrons of, office building tenants is not likely to be as great in such an occupancy as in a department store, the air raid precautions problem is sufficiently complex to demand the most careful attention. The Floor Wardens can and must play a central part in all emergency operations.

Each of the four squads making up the Building Control Unit deserves a brief word of description:

POWER CONTROL SQUAD—This group is assigned to looking after all building power units and is responsible for the centralized blackout power control.

MECHANICAL CONTROL SQUAD—This group is entrusted with the responsibility for elevators, heating, plumbing, and ventilating equipment and control during emergencies.

FLOOR SQUAD—This group, limited in number, will have representatives stationed on all floors, including those floors evacuated, to report any damage or fire to the Building Control Director.

FIRE CONTROL and RESCUE SQUAD—This squad is to be on call at all times for fire-fighting, handling of incendiary bombs, and rescue work. It will include extinguisher and hose operators, sand bucket brigades, débris clearance groups, and fire pump operators.

Since the fire control squad will play a most important protective rôle in the event of an incendiary bombing attack, especial attention has been given to its equipment and training. Outstanding among the building's fire-fighting apparatus are its two hand-propelled fire trucks, one of which is here illustrated.

As regards blackout precautions, a study has been made of the preliminary work necessary to prepare the building for such conditions. In general, it is proposed that the structure shall be prepared so that specifically designated areas can employ their usual lighting during periods of enforced darkness elsewhere. Of the areas to be darkened, some will be so treated from main switches in the building basement, some by the occupants before they leave the room, the remainder by having the windows painted out in advance.

One of the air-raid fire trucks for Western Union buildings in coastal and certain industrial cities. Each truck is equipped with 2 soda-acid and 2 CO_2 fire extinguishers, an axe, a bolt-cutter, 2 pairs of colored goggles, a crowbar, hammer, and hacksaw, 4 wrenches (2 Stillson and 2 spanner), 2 gas masks, 2 trouble lights with extension cords, 2 40-lb. drums of G-1 powder with scoops or shovels, 2 electric lanterns, a fog nozzle, a pair of side-cutting pliers, a 50 ft. rope, 2 salvage covers, and an asbestos blanket.

Because of the provision of shelter zones in the building for occupancy during air raids, certain minor changes in layout and some alterations have become advisable. This work has been directed by the division assigned to building changes and alterations. Insurance of a reasonable degree of safety has been the desideratum in every instance.

Such representative plans as these for the protection of hospitals, department stores, and office buildings necessarily suffer somewhat from any digested treatment. Too, what may be fitting and proper for one such occupancy may not be suitable for another of the same type. In every case, air raid and fire protection measures must be adapted to individual requirements, as determined by building structure, personnel organization, and similar purely local factors. There is, however, much of suggestive value in all such plans and it is for that reason that those already carefully established are deserving of examination. Too great emphasis cannot be placed upon the fact that those safety precautions and practices recommended for war-time emergency will, if properly observed, furnish very efficient and practical basis for any peace-time emergency organization.

The Boston Wool Fire.

Wool is a critical commodity. Vast quantities are needed for military requirements. Shipments from Australia, South Africa and other foreign sources are restricted by shortage of shipping facilities and the peril of submarine warfare. Civilian use of wool, to which we have long been accustomed as essential to comfort and health, is being restricted, as for example in the limitation in the use of wool in men's suits.

In ordinary times the destruction of wool by fire is an economic loss, which falls directly or indirectly on all of us, but wool destroyed can be replaced. Now, replacement, if possible, involves long delays. There is every reason, under present conditions, to take more than ordinary precautions to protect our existing wool stores against loss by fire. But if the fire in Boston on March 6, 1942, is any criterion, the vast supplies of wool accumulated in anticipation of a war shortage are being stored with little regard for the elementary principles of fire safety. The total quantities of wool stored, the locations and conditions of storage are kept confidential because publicity might be an invitation to arson or sabotage by enemy agents, and for this reason cannot be publicly discussed. But when a fire occurs, the facts become public property.

Wool is not a highly combustible commodity. It has a relatively low order of susceptibility to fire when compared with cotton and other combustible fibres. It is, however, definitely combustible, and is subject to damage by heat and water as well as by fire. It is subject to spontaneous heating in the presence of oil and moisture, and may ignite spontaneously under some conditions if the heating continues. Furthermore, wool is customarily stored in burlap-wrapped bales, or in burlap bags, and the burlap can be readily ignited by sparks or other small sources of ignition even though the wool itself does not ordinarily ignite from small sparks. The burlap also serves to spread fire rapidly.

The fire record of wool storage in recent years has been relatively good. Fires have occurred, and some have caused substantial losses, but on the whole the fire loss experience with storage handled through the established channels of the wool trade has not been subject to any serious criticism. Storage has for the most part been in buildings of good construction, largely under standard automatic sprinkler protection, and subdivided by fire walls into storage units of moderate size, thus limiting the potential damage in any single fire. But the present emergency storage has not been handled through the established facilities of the wool trade.

NOTE: This report has been prepared from information received from the Eastern Underwriters Inspection Bureau, the New England Fire Insurance Rating Association, the Boston Fire Department, N.F.P.A. Engineers present at the fire, and data from other sources.

International.

Fire involving 1,500,000 lbs. of wool in a Boston warehouse March 6, 1942. Sprinklers and automatic fire alarm system shut off. Fire doors not maintained. One watchman dividing his time between this and 11 other buildings.

Fire doors not maintained. One watchman dividing his time between this and 11 other buildings. Sprinklers and automatic fire alarm system shut off.

The Boston Fire.

Fire in a warehouse occupied by the National Wool Marketing Corporation in Boston on March 6, 1942, reflected an apparent disregard for several essential elements of fire safety. In this warehouse was stored wool in bags to a reported total of 1,500,000 lbs.* The building was completely involved in the fire when the fire department arrived. It was only through extraordinary efficiency of the fire department that the fire was extinguished so promptly as to permit a large salvage. The damage to the wool was thus limited to a reported $60,000, with a loss of $50,000 to the building. While the loss in this particular fire is perhaps relatively small in proportion to the total wool values, the facts of the fire seem highly significant.

The building was of the usual warehouse type, 6 stories, with substantial brick walls and heavy timber floor construction. The elevators and stairs were enclosed in brick shafts, the openings to which were protected by standard tin-clad fire doors.

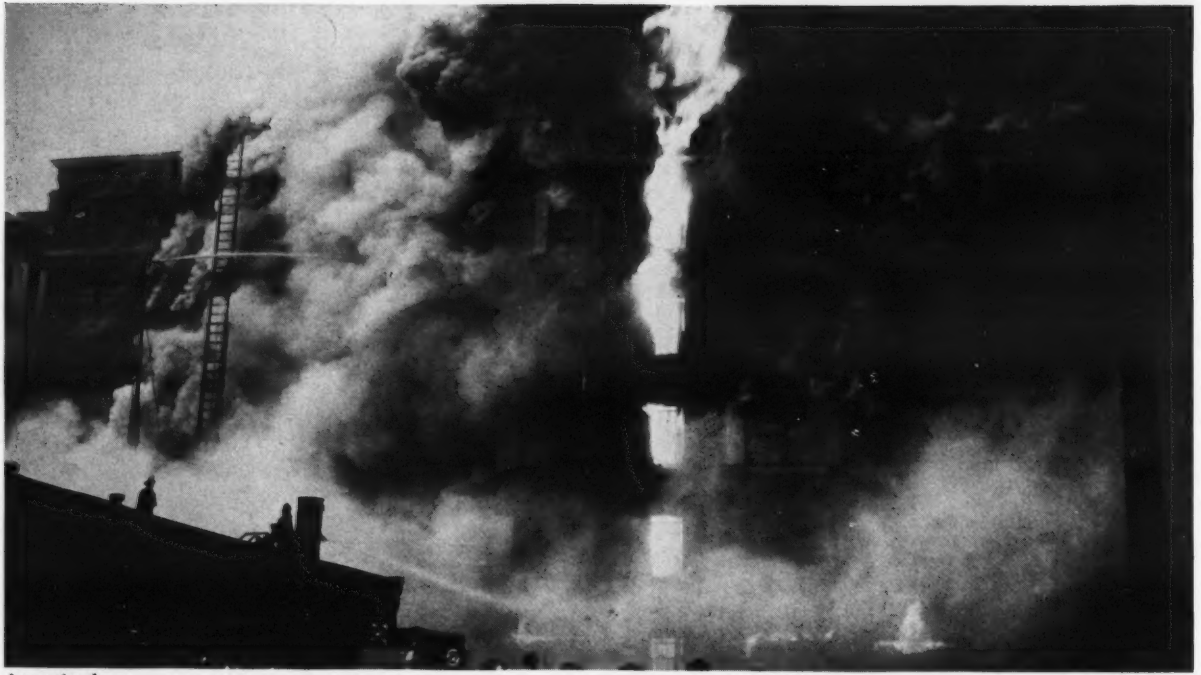
This building had formerly been occupied as a warehouse by a chain grocery organization. At that time it was completely protected both by a standard automatic sprinkler system and by a separate automatic fire alarm system with central station connection so that the fire department would be promptly called in case of any incipient fire. When the grocery concern vacated the premises the automatic fire alarm service was discontinued and the sprinklers were turned off.

When the wool storage occupancy was begun in August, 1941, neither the sprinklers nor the fire alarm system were restored to service. The fire doors were not properly maintained and were left open both in openings in a fire wall separating two sections and in some cases in the elevator shafts. Outside shutters designed to safeguard against exposure fires or the spread of fire from floor to floor by way of windows were left open in many places. Fire inspectors called attention to the hazards and suggested appropriate action. Apparently the owners of the wool viewed fire safety solely in terms of insurance, and had blanket insurance coverage which was not affected by conditions in the individual property, so nothing was done.

No watchman service was provided by the National Wool Marketing Corporation. A watchman was employed by the concern that owned the building, but this man had no control or responsibility over the contents and had to divide his time between twelve large buildings in the vicinity.

The wool had been in storage for some time, and the warehouse was closed when fire was discovered by a passer-by shortly before 7:20 A.M. He ran to a near-by fire station, less than a block away, and shouted to the firemen. The alarm was transmitted at 7:20 A.M., and the fire department response was im-

*The total value of the wool in storage has not been reported. The value of wool depends upon various factors and varies considerably. This wool may have been valued at around 50 cents per pound.



International.

Fire quickly spread up elevator shafts to involve the entire building. Bright flame marks an elevator shaft in this picture. Modern building codes require the protection of stairs and elevators by fire-resistive shafts, with doorways equipped with fire doors, to prevent the rapid spread of fire upward throughout the building, which is characteristic of fires in buildings with unprotected vertical openings. But when the fire doors are not in proper repair, or are left open, such protection is of no value.

mediate. By the time they arrived, however, flames had involved almost the entire building. Five alarms were sounded in quick succession, with a large concentration of fire apparatus and men under the able direction of Chief Pope of the Boston Fire Department. Twenty-six engine companies, three water towers, six ladder companies and one rescue company responded. The fire was deluged with water and brought under control before there had been time for the destruction of any large proportion of the wool. An exceptionally good water system with 12 in. mains, adequate pressure, and hydrants adequate in number and location and the accessibility of the building for fire fighting were important contributing factors.

The cause of this fire has not been ascertained; spontaneous ignition is suspected by the Fire Department. It might have been due to any of a number of causes. The immediate cause of the start of the fire, however, is relatively unimportant. What is significant is the rapid spread of fire throughout the building, owing to the conditions of neglect previously described.

Tentative

SUGGESTED MINIMUM STANDARDS FOR WOOL STORAGE.

(Based on N.F.P.A. Standards for Storage of Combustible Fibres, modified in accordance with the burning characteristics of wool, and war conditions.)

The following condensed outline assumes observance of established principles of fire protection, as covered in the various standards of the National Fire Protection Association, which should be consulted for further details. These suggestions are not intended to be complete, and should be supplemented by intelligent attention to the special fire problems of any individual property under consideration.

Storage Restricted to Wool Storage Buildings.

Wool should be stored only in buildings, or separate sections thereof, utilized exclusively for such storage. It should be removed as promptly as possible from piers, wharves, and other locations where it may be subject to danger from fire in other commodities stored in the same area, or from other exposure fires.

Buildings or sections used for the storage of other commodities, or for manufacturing, recreational or other occupancies should not be used for wool storage at the same time. Supplies of wool needed for current operation may be kept in manufacturing buildings housing wool processing operations.

Substantial Construction.

Buildings used for wool storage should be structurally sound and kept in good repair, tight against the elements, and well secured against the entry of unauthorized persons. Buildings of fire-resistive or heavy timber ("mill") construction are recommended; ordinary brick-joisted or frame buildings are undesirable. Floors should be dry, and well above any anticipated tide or flood water level. Basements should not ordinarily be used, but may be used in special cases where thoroughly dry and provided with adequate drainage to prevent possible flooding.

NOTE: Protection against rain entering through roofs or walls, or water on floors, is important because moisture may cause spontaneous heating. Where damp or oily floors must be used for storage, wool should be elevated on suitable skids or platforms.

These buildings, used for wool storage before they were taken over for other war emergency use, represent the idea of the wool trade for proper storage. Fire-resistive construction, well subdivided by fire walls and partitions, 9,900,000 cu. ft. total storage space. Now, the number of suitable buildings for wool storage is limited, and when a fire occurs the loss of storage space is an important factor, as well as the loss of wool.

Fire Protection.

Complete automatic sprinkler protection with water flow alarms is essential for all buildings of combustible, or partly combustible construction, and is desirable in all cases even though the structure is completely fire resistive.

Standpipe and hose systems should be provided for all unsprinklered buildings.

Hand extinguishers of types suitable for class A fires should be distributed throughout all buildings.

Outside hydrant protection with adequate water supplies should be available.

Alarm facilities for calling the municipal fire department should be available by means of private fire alarm boxes in the building or a conveniently accessible public alarm box. If the public box is not immediately visible, suitable signs should be provided to indicate its location.

Supervision and Maintenance.

"No Smoking" rules should be strictly enforced.

Heating and lighting and other electrical equipment should be kept in proper repair to minimize fire hazards.

Rubbish and any unnecessary combustible material should be removed from the premises.

Adequate heat should be provided to prevent the freezing of automatic sprinklers and other fire extinguishing equipment, unless of non-freezing types.

Wool after first being put in storage should be very frequently examined for evidence of any spontaneous heating, and should be checked at regular intervals thereafter.

Continuous watchman service should be maintained. (See N.F.P.A. pamphlet "The Watchman.")

Subdivision of Storage Aisles and Clearance.

Storage should be subdivided into individual piles of bags or bales not exceeding 2000 sq. ft. in area, and not exceeding 10 ft. 6 in. high, separated from adjoining piles by aisles not less than 5 ft. wide (preferably wider) and from exterior walls and interior fire walls by aisles not less than 3 ft. wide. No pile should extend to a height greater than 12 in. below automatic sprinkler pipes, and a clearance of at least twelve inches should be left under ceiling beams.

NOTE: These provisions are to provide access for fire fighting, for examination and removal of any wool that may be heating, to limit the spread of fire in the interior of piles, and to facilitate the distribution of water for fire extinguishment.

Limits of Storage.

The maximum storage in any one building or closely spaced group of buildings should be limited to 10,000,000 lbs. Storage in individual buildings should be limited as follows. Limits for single floor areas assume proper protection of all openings through which fire might spread.

Fire-Resistive Construction, Sprinklered	
Entire building	10,000,000 lbs.
Single floor area	2,000,000 lbs.
Fire-Resistive Construction, Not Sprinklered	
Entire building	5,000,000 lbs.
Single floor area	1,000,000 lbs.
Heavy Timber Construction, Sprinklered	
Entire building	6,000,000 lbs.
Single floor area	2,000,000 lbs.

One-Story Fire-Resistive Buildings, Sprinklered	
Entire building	10,000,000 lbs.
Single section cut off by standard fire walls	3,000,000 lbs.
Single section cut off by 1-hour partitions	2,000,000 lbs.
One-Story Fire-Resistive, Not Sprinklered	
Entire building	5,000,000 lbs.
Single section	1,000,000 lbs.
One-Story Heavy Timber Construction, Sprinklered	
Entire building	6,000,000 lbs.
Single section cut off by standard fire walls	3,000,000 lbs.
Combustible Construction, Detached, Not Sprinklered	100,000 lbs.

NOTE: The above limits are based upon adequate fire protection facilities, the use of proper types of buildings, and proper storage methods as hereinbefore specified. In case of deficiency in fire protection or other features of safe storage, the quantities permitted in any one fire area or building should be appropriately reduced.

The purpose of limiting the total amount in one fire area is to limit the loss to this maximum in case of any possible failure of fire extinguishing facilities. The limit on the total in one building or group of buildings limits the loss in case of spread of fire from section to section or building to building due to bombing, sabotage, or accidental circumstances.

Salvage.

After any fire in wool storage, salvaging operations should be started immediately. When work is done promptly by persons familiar with the proper handling of damaged wool, a high salvage value may be secured, but if charred, wet wool is allowed to stand without attention, greatly increased damage may be expected.

Weights.

The following approximate table of sizes and weights of types of bales and bags commonly stored is presented for convenience in estimating quantities. There is considerable variation in sizes and weights, and data from different sources are not in agreement.

Weights of Bales and Bags.

	Approximate Size	Approx. Average Weight, Lbs.
Australian, single bales	31″ x 31″ x 48″	325–350
	31″ x 32″ x 33″	290–320
Australian, "Double Dump" bales	31″ x 31″ x 42″–48″	700
South American, large bales	28″ x 35″ x 58″	1000
South African ("Cape") bales	30″ x 30″ x 32″	300
	36″ x 36″ x 36″	320
American bags	27″ x 30″ x 6½′–7′	300–330

Boston Waterfront Fire.

Despite the handicaps of unusually hazardous conditions, winter weather, and a delayed alarm, the Boston Fire Department succeeded in confining a four-alarm fire in Shed No. 45, Mystic Terminal Company pier at Charlestown, to the section involved upon arrival. Fire fighting efforts were materially aided by a blank fire wall and by automatic sprinklers in the pier shed. The fire started in an unsprinklered area beneath the pier on the morning of February 5, 1942. Damage was estimated at $225,000.

Construction and Protection.

The structure involved was a one-story frame pier shed 1070 feet long and approximately 75 to 80 ft. wide, with a joist roof and a single 2-inch plank on 3 by 12 in. joist floor. Approximately two-thirds of the width of the shed was on timber posts 4 to 6 feet above ground and one-third was on piling over water.

The structure was divided into two unequal fire divisions by means of a blank brick parapeted and winged wall extending to the ground over the land and by a boiler plate curtain extending to mean low tide over the water. The section involved is further divided at the first floor into five unequal areas by metal clad partitions, but without substructure divisions.

The pier shed was protected by a dry pipe sprinkler system controlled in the fire area by four dry pipe valves and supplied by a 100,000-gallon gravity tank and the city low pressure water system. The space under the building was not sprinklered. Sprinkler alarm valves were connected to local rotary gongs and to a local central station.

In addition, a fire alarm system thermostatically operated and equipped with manual boxes was provided. An unsupervised watchman made hourly rounds.

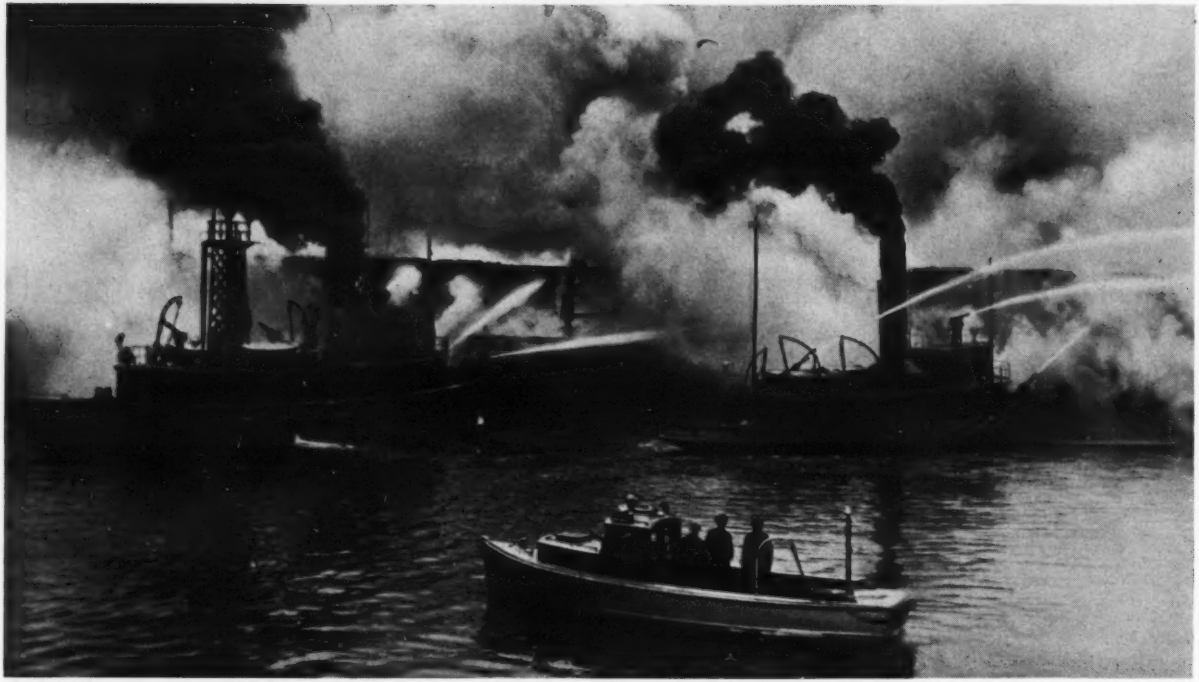
The entire section east of the brick division wall was occupied by the First National Stores, Inc., chain retail grocers, for the storage and distribution of grocery products.

Story of the Fire.

At about 8:15 A.M. on February 5, 1942, one of several carpenters engaged in repair work in the unsprinklered space under the shed discovered a very small fire on the ground near his work. The exact cause of the fire has not been determined, but it is believed due either to careless smoking or to a match used for illumination.

In an effort to smother the fire with what he assumed to be earth, scooped up in his hands, the workman actually intensified the fire and a severe fire

NOTE: This account is based upon data contained in a report by the Eastern Underwriters Inspection Bureau (member N.F.P.A.).



International.

Heavy streams from the monitor nozzles of fireboats, supplemented by hand lines from the land side, were massed to cover the blank fire wall in Pier No. 45, on the Charlestown waterfront at Boston, Mass., during a fire on February 5, 1942. Supplemented by the operation of 700 or more sprinkler heads, these streams were successful in holding the fire to the portion of the pier involved when the fire department arrived.

rapidly developed. This was due to the fact that for a number of years (until 1938), the three westerly sections of the building had been used for the storage and handling of sodium nitrate. Accordingly the floors were impregnated with the nitrate and the space under the structure contained an appreciable amount of nitrate which had filtered through the floors. Thus the earth used to smother the fire was in reality a mixture of sodium nitrate and other combustible débris deposited over a long period of years.

Delayed Alarm.

Immediately upon reaching the floor of the shed, one of the workmen operated a manual fire alarm box. For some reason not yet determined, neither the box nor the automatic fire alarm system operated. This alarm system was an old open circuit system installed some time prior to 1905. It is connected to a local central station. The operator of the central station is an employee of the Boston and Maine Railroad. His duties were chiefly concerned with supervision of sprinkler alarms. There is no supervision of the thermostat system by the operator, and although the fire alarm circuit was occasionally tested by a hand operated device, with the open circuit type of system such a test, under some circumstances, may not be able to detect failure of the system.

The first alarm to the fire department was received at 8:30 A.M. from a public box about one-half mile from the fire, indicating a delay of about fifteen minutes in transmitting an alarm. Immediately following this alarm sent in by a citizen, the operation of the first dry pipe valve was recorded at the local central station.

Fire Fighting Operations.

The response to four alarms included 19 engine companies, 3 fireboats, 4 ladder companies, and a rescue company. The fire department used 25 lines of 2½-inch hose, 16 deck guns and 1 portable gun. In addition, two "pup" boats (motor tenders carried on each fireboat and equipped with 1¼-inch hose) were effectively used to extinguish fire under the pier which would have been difficult of access by other means. Fire Chief Samuel J. Pope of the Boston Fire Department assigned a detail of men with hose lines to take a stand at the blank brick fire wall. No fire spread beyond that point.

All four dry pipe valves controlling sprinklers in the fire area operated. In excess of 700 sprinkler heads fused and were of unquestionable value in limiting the extent of the fire. However, as the blaze originated in the unsprinklered substructure and spread up the combustible outside walls, credit is due the fire department for controlling a serious fire in an old wooden pier.

Damage.

According to estimates, damage to the pier shed was approximately $125,000. Loss to the contents may exceed $100,000, but being largely damage from water, considerable salvage is likely.

the operation of 700 or more sprinkler heads, these streams were successful in holding the fire to the portion of the pier involved when the fire department arrived.

Acme.

Pier No. 83, North River, New York City, was destroyed in an early morning fire on January 8, 1942, with a loss estimated at $435,000. The pier structure, of combustible roof and floor construction, was 570 feet long, without any firebreaks either in the pier shed or in the substructure. The collapse of corrugated iron side walls on unprotected steel supports blocked access for fire fighting.

Another New York Pier Fire.

The third major pier fire in eight months in the Port of New York originated in Pier No. 83, North River, at approximately 4:38 A.M. on the morning of January 8, 1942. Within a few minutes the flames had spread throughout the structure, extended to adjoining waterfront properties, and to a ship docked at the pier. The fire enveloped the pier with such rapidity that firemen responding to the first alarm were forced to abandon their apparatus upon the pier in order to save their lives. It was necessary to sound five alarms before adequate fire department response was obtained to control the blaze. The spread of the fire was not checked until the entire superstructure of the pier and the baggage room of an adjoining ferry house were a mass of wreckage, and the pier deck and portions of the substructure were badly charred. The loss totaled about $435,000.

The report of the New York Board of Fire Underwriters sums up the fire as follows:

"This fire definitely demonstrates that these large pier fires are fundamentally and basically due to first, the lack of thought for fire protection in the original pier design, and second, the lack of correction to that original design even in view of ample evidence for the necessity of corrections and definite knowledge concerning what corrections are necessary. This fire again clearly proves with certainty the conflagration hazard of the majority of piers in the Port of New York and the exposure hazard they present to adjacent property.

"The lack of attention in correcting the conflagration characteristics of these piers is definitely detrimental to the National Defense effort."

Construction and Protection.

Pier No. 83, North River, was 590 feet long and 73 feet wide, with a one-story pier shed. The pier deck consisted of a double plank flooring 8 inches thick. The superstructure was on wood girders and piling except for about 50 feet from the shore end which was on the ground. The walls of the pier shed were corrugated iron on unprotected steel. The roof was slag on 1½-inch wood planking supported by unprotected steel purlins and trusses carried on unprotected steel side wall construction.

The pier shed was without fire walls, curtain boards or draft stops. The substructure lacked fire stops or other substructure fire protection. A two-story bulkhead building of similar construction was completely open to the pier on the first floor.

The adjoining ferry house covered an area of 50,000 square feet. The baggage room of the ferry house was enclosed in corrugated iron on steel frame con-

NOTE: Data for this account have been obtained chiefly from a report by the New York Board of Fire Underwriters (member N.F.P.A.).

The collapse of corrugated iron side walls on unprotected steel supports blocked access for fire fighting.

struction similar to the pier. A 12-inch reinforced concrete fire break extends from deck of the baggage room to mean low water between the baggage room and Pier No. 83.

Fire protection on the pier was limited to one 3-inch standpipe supplied by a 6-inch connection to the city main with 2½-inch outlets equipped with 50 feet of 2½-inch rubber lined hose. Fire department connections were located at the shore and river ends of the pier.

Occupancy.

The merchandise on Pier No. 83 primarily consisted of 6114 bags of gum arabic, 1000 bags of coffee, and 3429 bags of copra, covering only about 35 per cent of the deck area of the pier. The major portion of the merchandise was piled not over five feet high. The copra covered a space of about 60 by 30 feet, piled not over ten feet high. It was a part of a shipment being discharged from the steamship *Lancaster*. The bulkhead building and the baggage room of the ferry house were practically unoccupied.

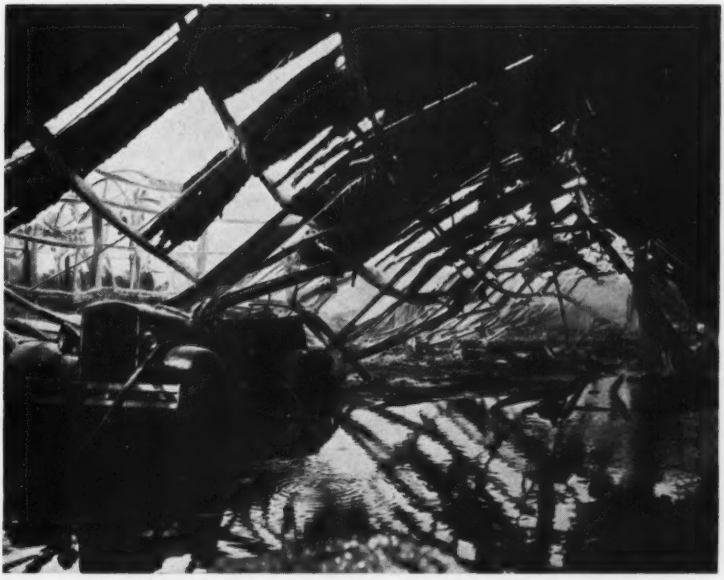
Story of the Fire.

The steamship *Lancaster* began discharging copra the evening before the fire and was still in the process of unloading when the fire occurred. The copra (dried kernel of cocoanut) was in burlap bags and was being stacked along the south side of the pier about a third of the way from the river end. The fire was discovered in bags of copra at the top of the pile by longshoremen. They attempted to beat it out with their coats. The cause of the fire is not known, although the investigation by the city fire marshal indicated evidence of careless smoking or careless use of matches.

Two lines of hose stretched from the pier standpipe system proved of little value. In the meantime a watchman near the fire called to another watchman near the gate who proceeded to a fire alarm box about 300 feet from the pier entrance and sent the first alarm to the fire department.

Because of another fire in the vicinity, the usual first alarm companies, with the exception of a fireboat, were not available. It was necessary for the fire alarm office to dispatch an engine and a ladder company and a battalion chief to cover the first alarm assignment which would normally have included four engine companies, two ladder companies and three chief officers in addition to the fireboat.

In order to reach the fire the only engine company answering the first alarm found it necessary to stretch lines down the pier from the land end a distance of approximately 450 feet. The fire spread so quickly, however, that before the Fire Department could place effective streams in operation the firemen were forced to abandon their equipment to save their lives. Several firemen were severely burned before reaching safety. Other firemen cut off by the fire were rescued by a fireboat from the river end of the pier.



Acme.

Ruins of a fire department truck trapped in the rapidly spreading fire may be seen amid the ruins of Pier No. 83. This machine was the hose truck of the only engine company dispatched in answer to the first alarm. Several firemen responding with this apparatus were burned before they could escape the sweep of the flames through the long open pier shed.

Thirteen minutes after the first alarm, a second alarm was sounded by the fire alarm dispatcher upon receipt of orders to complete the first alarm assignment. Subsequently, a total of five alarms were sounded, bringing 22 engine companies, 3 fireboats and numerous other special units in addition to 6 chief officers. Upon the arrival of the second alarm apparatus the pier was completely enveloped by fire and the Fire Department's efforts were concentrated successfully in preventing the spread of the fire to the ferry house and other waterfront property. In addition, it was necessary to tow the steamship *Lancaster* into the river, where the fire on its bridge was extinguished by the ship's crew. Considerable difficulty was experienced in completely extinguishing the fire in the pier substructure and this work was not accomplished until approximately 116 hours after the first alarm. Fire fighting efforts were hampered by extreme cold and high winds.

Conclusions.

The report by the New York Board of Underwriters points out that the fire originated while men were at work upon the pier, that it was discovered in its incipiency, and that there was no material delay in sounding an alarm or

in the response of the first fire equipment. Nevertheless, the spread of the fire was so rapid that the firemen were forced to abandon their equipment to save their lives. The report also observes that every pier superstructure constructed as one large open area without draft stops and fire walls constitutes nothing more than a long horizontal flue. When a fire occurs flames and hot gases rise to the underside of the roof and descend at various points along the pier, spreading the fire very quickly throughout the structure.

The report observes:

"It is not particularly difficult to see that a transverse fire wall extending across the superstructure of a pier and provided with proper fire doors where openings are necessary will break up the flue-like nature of the pier. Such fire walls also provide protection for the operation of the Fire Department who are already handicapped by the fact that the land forces are practically restricted to fighting the fire only from the narrow shore end. A fire wall constructed as specified by the 'Recommended Good Practice Requirements for the Construction of Piers and Wharves as recommended by the National Fire Protection Association,' may consist simply of two thicknesses of 2-inch tongue and grooved board with ¼-inch asbestos or gypsum boards between nailed together, with door openings protected by doors having fire-resistive qualities equal to the walls. It is reasonable to assume that had there been only one such wall located in the center of the superstructure of Pier No. 83 the loss would have been reduced by at least 50 per cent.

"It would seem that those responsible for the protection of piers and wharves in New York City should give immediate consideration and attention to correcting these very obvious defects in pier construction. In so doing they will not only reduce this continued needless hazard to life and property, but render a real service to the work of National Defense.

"Even though inspections are regularly and carefully made these excessive losses will not be prevented until proper steps have been taken to alter the conflagration characteristics of many piers. The hazard is severe on piers that are not provided with superstructure fire walls and automatic sprinklers. In addition, substructure protection is necessary.

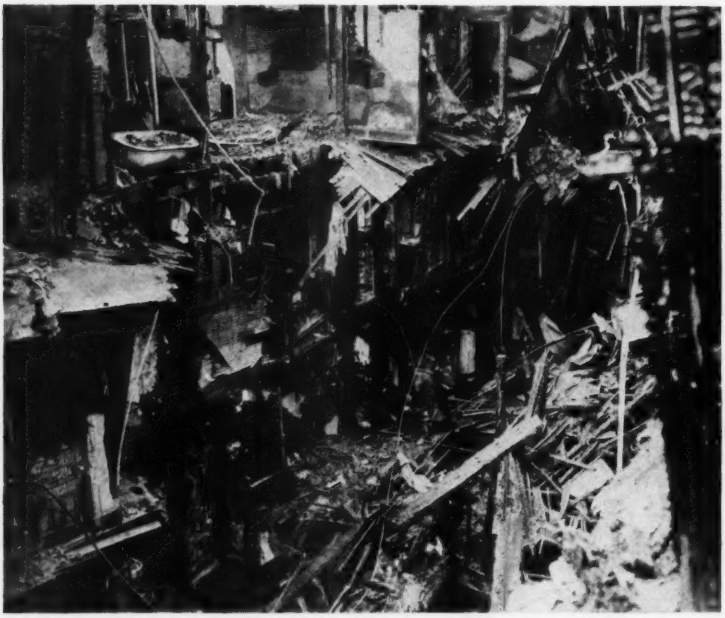
"Thoroughly consider that Pier No. 83 was of the usual type of construction of this class of pier having non-combustible side walls of corrugated iron on steel framework, a plank roof on steel trusses and a heavy plank deck, also that only about 35 per cent of the floor area of the pier deck was covered by merchandise which was piled very low and that could not be considered as being very flammable material."

Lynn, Mass., Apartment House Fire.

Thirteen persons lost their lives and more than a score were injured when the Melvin Hall Apartments in Lynn, Mass., were destroyed by fire in the early morning of January 20, 1942. The death list included three men, nine women, and a child of three and one-half years. The tragedy, one of the worst in the history of the state, was another gruesome illustration of the well-established fact that a brick exterior shell does not mitigate the hazard of a wooden fire trap.

The Melvin Hall apartment building was erected in 1896 as an apartment hotel and had been remodeled twice since that date. It was a brick and joist structure five stories in height, the first floor being occupied by a large store and a café, with the basement area divided between a hand laundry, the furnace room, and various storage sections. The four upper floors were devoted exclusively to living quarters, one and two-room apartments. In theory, there were three means of leaving the structure: two stairways, front and rear, at the end of the halls, and a central stairway which turned about the elevator shaft. This open shaft extended the entire height of the building. All three stairways were connecting and were without fire doors or cut-offs. Lacking automatic sprinklers or an alarm system of any kind, the private fire protection was totally inadequate. The building was served by but one fire escape. This, built in a narrow airwell between the apartment house and an adjacent building, was accessible only to a few people on the fourth and fifth floors and proved of little use.

The blaze, discovered shortly before 2 A.M. on the morning of January 20, is believed to have begun in the basement, but the actual point and cause of ignition have not been determined. Within a very few minutes the fire had spread from the basement to the upper floors by means of the open elevator shaft and open stairway. The building's occupants, belatedly aroused to their danger, rushed in panic into the smoke-filled hallways. They found that smoke and flame made the main stairway impassable. Some used the other stairways, but many tenants were not familiar with any exit except the main stairway and were unable to make their way through the smoke. They ran back into their rooms, or flung the windows open, and screamed for help. Many leaped blindly to the street below, where firemen made valiant but in several cases unsuccessful efforts to catch them in life nets. A number of persons sustained injuries and some met death when they struck the concrete pavement or the ground in their falls. In the fog and smoke and darkness, firemen attempting rescues at other points with an aerial ladder were guided by the sound of the screaming and the shattering of glass rather than by sight. The rescue

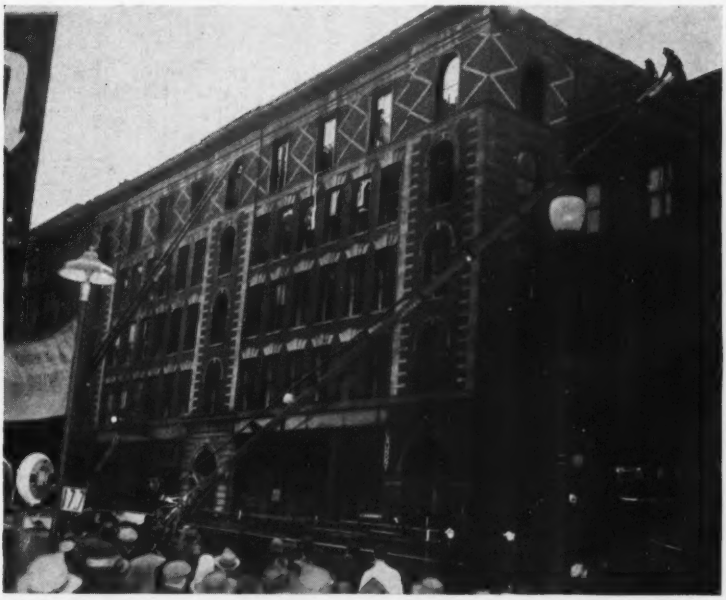


International.

A section of the Melvin Hall Apartments in Lynn, Mass., after fire had claimed the lives of thirteen, injured more than a score, and destroyed approximately $60,000 worth of property. Stairways and an elevator shaft spread the flames rapidly through the brick and joist structure, almost before rescue operations could be begun.

operations of the 28 fire companies and 7 ambulance units which had responded to the second alarm in accordance with mutual aid plans were carried out as effectively as could be expected under such adverse conditions. Ten cities had sent apparatus, and fire-fighting activities included the playing of heavy streams upon the building and the wetting down of adjacent and surrounding structures. Water supplies were entirely adequate, being obtained chiefly from 12″ mains along the street on which the apartment house fronted.

Unlike many similar night fires in which all of the occupants of a dwelling are asleep, the evidence in this instance revealed that there were a number of people up and awake at the time of its outbreak. The fact that these people did not know there was a fire until after the flames and smoke had progressed so far as to block and render useless the normal exits from the building leads to the conclusion that the fire must have been burning for a considerable length of time in the basement or other unoccupied area. In such a case the flames might well be expected to burn through doors and partitions and create a draft up the open stairways, involving the entire structure swiftly. There can be lit-

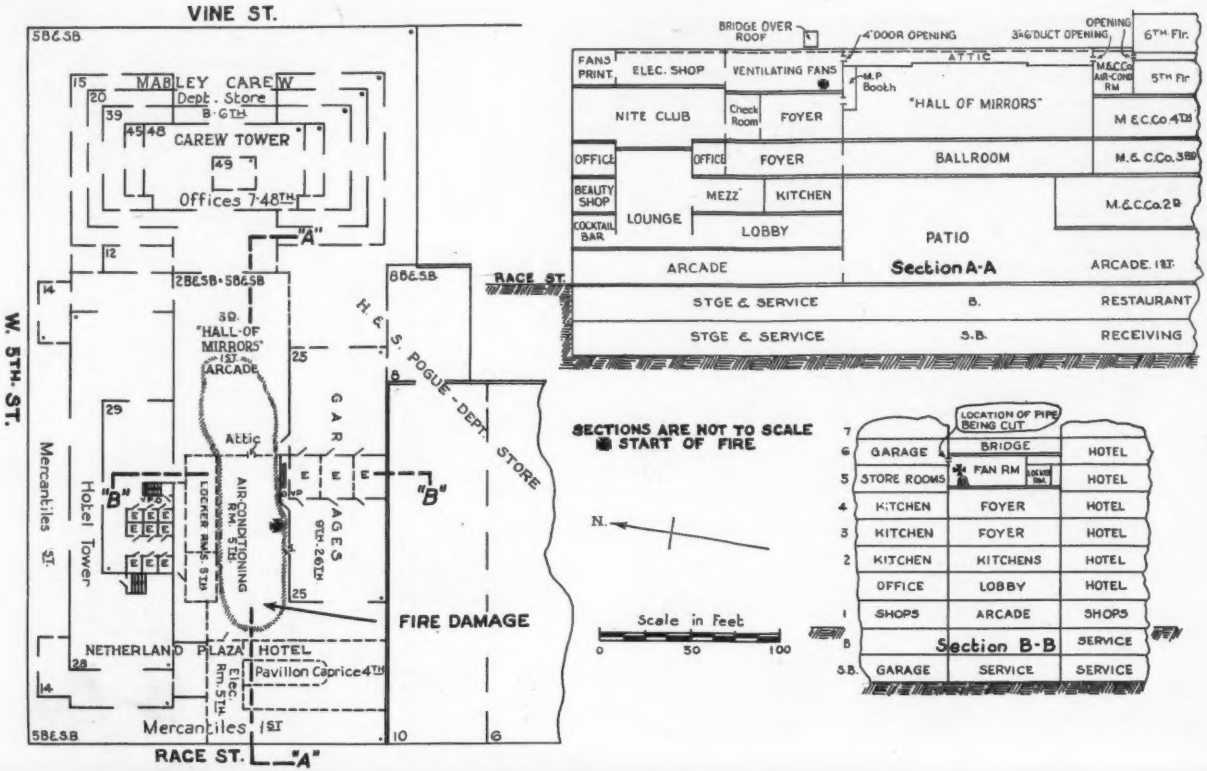


International.

This view of the Melvin Hall Apartments reveals the seemingly substantial character of its brick exterior. That exterior proved, however, to be a "false face" concealing a woefully unprotected structure which the flames gutted within a few minutes.

tle question but that automatic sprinklers would have controlled any such fire in its incipiency. Circumstances might admittedly prohibit the installation of sprinklers in individual apartments, but they should be required throughout the basement area, in stores, restaurants, and similar street floor occupancies, and for the protection of stair and corridor exits. The experience in Boston, where such protection is required by law under specified conditions, has been very favorable. There has never been any loss of life by fire in a building thus equipped with automatic sprinklers.

Most important, however, as regards the loss of life in this fire, was the fact that Melvin Hall was a five-story building. The Building Exits Code, official standard of the N.F.P.A., specifies four stories as the maximum height of ordinary brick, wooden interior buildings for apartment house occupancy, unless safeguarded by the installation of automatic sprinklers. The wisdom of this four-story limit is clearly indicated by the Melvin Hall tragedy, since most of those who lost their lives were on the fifth floor when the firemen arrived.


VINE ST.
MABLEY CAREW
Dept. Store
B-6TH
CAREW TOWER
Offices 7-48TH
"A"
"HALL-OF MIRRORS" 1ST ARCADE
Attic
AIR CONDITIONING RM. 5TH
LOCKER RMS 5TH
GARAGES 6TH-26TH
"B"
Hotel Tower
Mercantiles ST.
W. 5TH. ST.
H. E. S. POGUE - DEPT. STORE
RACE ST.
FIRE DAMAGE
NETHERLAND PLAZA HOTEL
Pavillon Caprice 4TH
Elec. Rm. 5TH
Mercantiles 1ST
RACE ST.
"A"
BRIDGE OVER ROOF
4' DOOR OPENING
3'6" DUCT OPENING
OPENING
ATTIC
6TH Flr.
5TH Flr
FANS
PRINT.
ELEC. SHOP
VENTILATING FANS
M.P. Booth
M & C Co AIR-COND RM
NITE CLUB
Check Room
FOYER
"HALL OF MIRRORS"
M.E.C.Co. 4TH
OFFICE
OFFICE
FOYER
BALLROOM
M.E.C.Co. 3RD
BEAUTY SHOP
MEZZ
KITCHEN
M.E.C.Co. 2ND
COCKTAIL BAR
LOUNGE
LOBBY
PATIO
ARCADE
Section A-A
ARCADE. 1ST.
STGE & SERVICE
B.
RESTAURANT
STGE & SERVICE
S.B.
RECEIVING
SECTIONS ARE NOT TO SCALE
START OF FIRE
N.
Scale in Feet
0
50
100
LOCATION OF PIPE BEING CUT
BRIDGE
GARAGE
FAN RM
STORE ROOMS
KITCHEN
FOYER
HOTEL
KITCHENS
LOBBY
SHOPS
ARCADE
Section B-B
SERVICE
GARAGE

Netherland Plaza Air Conditioning Fire.

Report by Ohio Inspection Bureau.
(Member N.F.P.A.).

Fire in the air conditioning room of the Netherland Plaza Hotel, Cincinnati, January 21, 1942, was extinguished with little spread from the immediate area of its origin, but smoke and water caused extensive damage to the modern fire-resistive building and its contents. The building, known as the Netherland Plaza Hotel and Carew Tower, included two department stores and several small stores, a garage, and an office building tower. The aggregate loss, including use and occupancy, was over $500,000. The fuel for this fire was combustible insulation on air conditioning ducts, applied without the fire-resistive covering specified by N.F.P.A. standards.

Construction, Protection, Equipment.

This property is a modern 5 to 48-story fire-resistive building, covering half a city block in the heart of Cincinnati. It consists principally of a 48-story office section (known as Carew Tower), a 28-story hotel section (Netherland Plaza) and a 25-story parking garage, all rising above and surrounding the 5-story section containing public rooms of the hotel, two large department stores, and numerous small mercantiles. Protective features include standard watch service, chemical extinguishers, standpipe and hose equipment both for first aid and fire department use, and automatic sprinklers in the stores, garage, hotel kitchen, work and storage rooms, etc. Sprinklers and the standpipe and hose systems are under proprietary supervisory alarm service. This was not a factor, as there were no sprinklers in the area where the fire started, and the proprietary supervisory system for the standpipes was out of service.

The scene of the fire was an air conditioning equipment and ventilating fan room on the top floor of the 5-story section between the higher hotel and garage areas. The room was unsprinklered. It had a poured gypsum roof on exposed steel purlins supported by protected steel beams and columns. The air conditioning equipment consisted of several complete units, each utilizing two fans, one for exhaust and one for supply, with independent fresh air intakes and with exhaust vents through the fifth floor roof. The capacities of the systems ranged from 10,000 to 40,000 cu. ft. per min., and conditioning included heating, humidifying, cooling and filtering, using traveling screen, oil-coated air filters. Heating was accomplished by low-pressure (5 lbs.) steam, and cooling by circulating chilled water from refrigerating compressor equipment lo-

Mr. J. T. W. Babcock of the Western Factory Insurance Association (Member N.F.P.A.) assisted in the investigation of this fire and furnished the photographs.

cated in the sub-basement. Altogether this air conditioning equipment room contained 27 electric motors, 23 of which were for driving various fans.

The air conditioning systems was installed in 1937, replacing an old carbon dioxide cooling and refrigeration system. It was understood that the fan and equipment room was to be sprinklered after the more modern conditioning system was installed, but this was not done.

There were several respects in which the air conditioning installation departed from accepted standards. The air conditioning units and ducts which were of unlined metal, were covered with two layers of 1-in. cork slabs attached by metal screws and a hot asphalt or pitch mastic. The insulation was attached by first coating the metal surfaces with the hot mastic and then applying a 1-in. slab of cork. Then the surface of the cork slab was coated with the mastic and another 1-in. slab superimposed. The second slab was then coated with the same type of mastic and troweled smooth. The use of combustible insulation of this type without a fire-resistive covering is not permitted by the N.F.P.A. Standards on Air Conditioning.

The switches controlling the fans and other equipment were located in the fan room and could not be reached when flames filled that area. In order to shut off the equipment it was necessary to pull the main switch in the sub-basement. Safety considerations would indicate the advisability of having control switches readily accessible at a convenient point outside of the fan room.

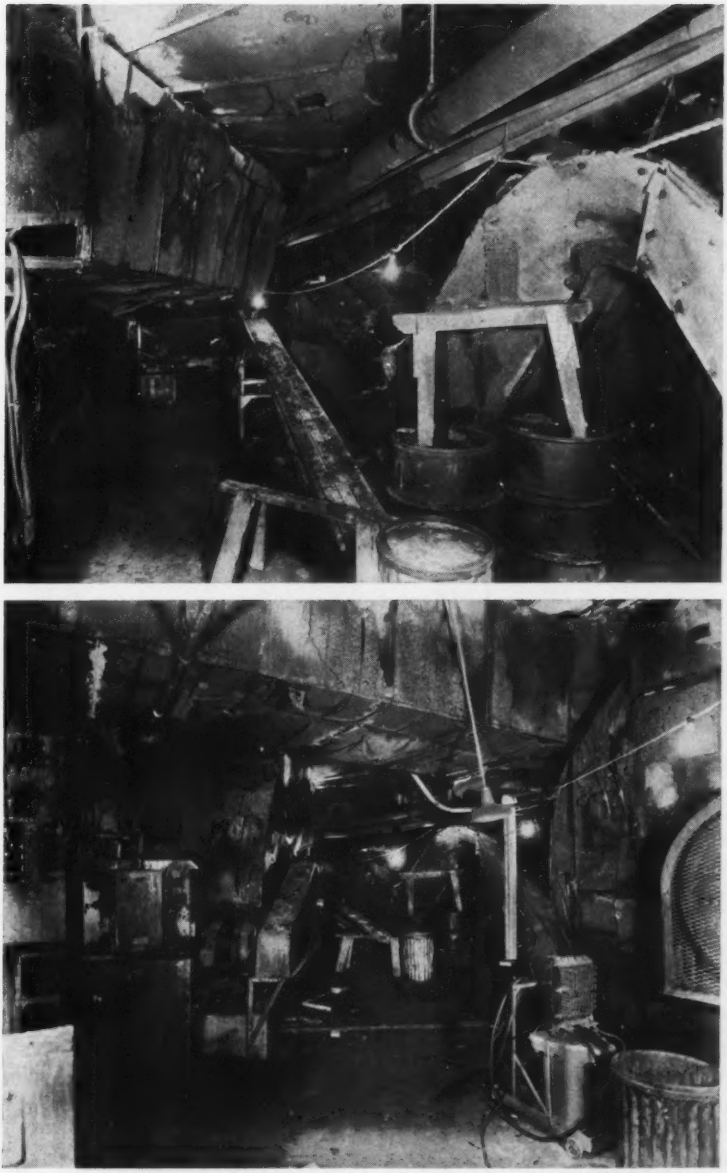
Plasterers who had been working in the garage section had placed some scaffolding lumber and drop cloths in the air conditioning equipment room earlier on the day of the fire. It was claimed that it was contrary to orders issued by the hotel to store any such material in that room and that specific orders had already been given for the removal of this storage. However, the material was still there at the time of the fire.

Start of the Fire.

About two o'clock in the afternoon a contractor's workman who was assisting in the construction of storage rooms in the garage section started to cut away with an acetylene cutting torch a 3-in. pipe which no longer served any purpose. One end of this pipe projected into the garage building on the sixth floor and the other end terminated near the roof of the fan room just over the cork covered air ducts and above the drop cloths, scaffolding, etc., which had been left there. Sparks from the cutting torch may have followed through the pipe and, unknown to the workman, landed on the cork insulation or on the drop cloths. In any event the fire started at this point.

Hose Streams Used by Employees.

The fire was soon discovered by workmen, who made immediate efforts to extinguish it by using small hose streams from the garage building standpipe. In a short time, hotel employees, who were more experienced in the use



Two views of the air conditioning room where the fire started. Note remains of cork insulation on the ducts.

of fire extinguishing equipment, arrived on the scene. One of the employees went to the sub-basement and opened the main switch, cutting off all current to the air conditioning equipment room. This was necessary because the switches controlling fan motors were inaccessible due to the fire. Additional standpipe lines were brought into use from standpipes on the fifth, sixth and seventh floors of both the hotel and garage.

The workmen broke holes through the roof of the air conditioning equipment room and also through the tile wall between it and the garage and through these openings directed the hose streams. The hotel employees broke additional holes through the roof when they found that the heat and smoke from the burning cork and mastic prevented their getting far enough into the room to use the hose streams effectively. Apparently the arrangement of the numerous air ducts under the roof interfered with the hose streams so that they could not actually reach the seat of the fire.

Several of the linen hose lines became tangled and burst, due in part, no doubt, to the high pressure of the standpipe (about 300 lbs. per sq. in.). The hose outlets are fitted with restricted orifice discs designed to reduce the flowing pressure to 50 lbs., but with a kinked hose the initial pressure of 300 lbs. was soon reached. Some of the hose is said to have been old and was scheduled for replacement.

Spread of Fire and Smoke.

The fire continued unabated, feeding upon the combustible insulation. There was at the time of the fire an unprotected opening between the air conditioning room and the attic space above the Hall of Mirrors, to give access to the attic for servicing lighting equipment in the Hall of Mirrors ceiling. As the fire progressed, smoke and flames found their way into this attic space and eventually ignited a wooden walkway in this area. At the other end of the attic, alterations were under way to enlarge a locker room in the Mabley & Carew department store. To make way for this change some unused ventilating equipment and ducts were removed and a large opening was cut temporarily in the partition wall between the Hall of Mirrors attic and the air conditioning room which serves Mabley & Carew's fifth floor. Smoke soon found its way into this air conditioning room and thence passed through openings from it into the concealed space above the fifth story ceiling of the department store and through openings around the ceiling light fixtures into the fifth story and through openings around pipe holes to the sixth story of the department store. The air conditioning equipment in the department store was not in itself a material factor in the spread of smoke. Department store employees had shut down all of this equipment and closed fire dampers as soon as they were aware of the fire in the hotel section.

Firemen and employees on the roof over the air conditioning room.

City Fire Department Called.

In the meantime, the public fire department had not arrived. One of the hotel employees stated that shortly after the start of the fire he reported it to the Fire Department by telephone. However, the fire department records indicate that the first alarm was by a telephone call from a policeman on the street who saw smoke filling the hotel arcade. This was at 2:27 P.M. The call was made from a location about one block from the fire and when the department responded further delay resulted because it was necessary for the apparatus to travel three extra blocks in one-way city traffic to reach the most advantageous location. By the time the firemen arrived at the actual scene of the fire several holes had been cut through the fan room roof and hotel employees had in operation six or eight 1½-in. linen hose lines. The firemen at first attempted to enter the fan room, but the heat and smoke discouraged this means of approach.

The fire department then enlarged the holes which had been made in the roof and inserted cellar nozzles supplied by 1½-in. hose lines, eventually using four of these together with three large solid nozzles to bring the fire under control. Meanwhile at 2:43 the Assistant Chief sent in a second alarm and at 2:50 the Chief ordered a third. In all, there were 13 engine companies, 3 ladder companies, a water tower and the Underwriters Salvage Corps on the

The Hall of Mirrors suffered extensive water and smoke damage, though fire extended only to a wooden walkway in the attic space above the ceiling.

scene. Two of the large fire department lines were taken from standpipe outlets on the fifth and sixth floors of the hotel. These standpipes are supplied by an automatic fire pump delivering 750 g.p.m. with a pressure of 325 lbs. at grade. The other five hose lines were hoisted to the roof from pumpers taking suction from the special 175-lb. pressure fire mains. One of the first companies to arrive laid lines to the sprinkler and standpipe siamese connection, but these were not used.

At 2:39 P.M. two sprinklers in an adjoining storage room in the garage section were opened by heat passing through two small pipe holes in the division wall. These sprinklers may have been a factor in preventing the spread of fire to this room.

Smoke and Water Damage.

The fire department continued to pump water into the air conditioning room and it spread throughout a considerable area of the building. It flowed through the attic over the ornately decorated Hall of Mirrors, bulging the ceiling and finally breaking through. It found its way through the ceiling of the Pavillon Caprice, the hotel's famous night club. Carpets and parqueted flooring were soaked and the water cascaded down the broad stairs to the mezzanine, on down to the main lobby and lounge, then to the street level arcade below and finally to storerooms and the basement. All firemen not actually engaged in fire fighting, all available members of the Salvage Corps and a large number of hotel employees assisted in sweeping water down the main stairways to the street. The Salvage Corps used all available covers to afford as much protection as possible to furniture and merchandise.

Smoke continued to pour out from the air conditioning equipment room as the result of the burning cork and mastic. It permeated to many parts of the building through air ducts and windows overlooking the fire.

It was probably 4:00 P.M. before firemen entered the room and attacked the remaining fire, which was finally brought under complete control at about 4:15 P.M. Smouldering embers were still being encountered as late as the following morning.

The actual fire damage itself was comparatively small, being confined to the air conditioning room and to the wood walkway over the Hall of Mirrors. The fire did not involve the oil-coated air filters or the heating and cooling coils. Considerable electrical equipment, motors and ducts were damaged, but fortunately the ammonia piping for kitchen refrigeration which terminated in this room was not ruptured or damaged except that the insulation was burned off. The unprotected steel purlins buckled and a good portion of the roof over the air conditioning room will have to be rebuilt. Part of the roof and ceiling over the Hall of Mirrors was similarly damaged. Steel beams and girders that were protected by tile fireproofing apparently suffered no damage except that quite a bit of the tile spalled off, leaving the steel unprotected. This spalling was probably caused by the hose streams which then served to keep the steel cool. The expansion of unprotected steel purlins broke several holes in the tile fire wall panels separating the air conditioning room from the garage.

There have been some comments to the effect that the fire department was too liberal in the use of water and that it was that fact that accounted for much of the large loss sustained. It is true that the fire did not involve a very large

area, yet in defense of the fire department's action attention has been called to the fact that the fire did burn with intensity and developed considerable heat and that it was feared for a time that the main columns and beams supporting the garage tower might become weakened and cause collapse of this high section.

Smoke damage was appreciable throughout the entire group of buildings, including the hotel, two department stores, offices, garage and numerous small mercantiles. Smoke poured from bathroom ventilators in many of the hotel guest rooms. Some of the smoke damage in various sections is accounted for by the fact that the fans supplying the ventilating and conditioning systems were not immediately stopped when the fire started.

Loss.

The loss to the building, which is insured for $9,500,000, is estimated at $250,000. Damage to the contents of the hotel is estimated at $75,000, and to the department store at $70,000. Use and occupancy losses, and damage to the contents of small shops, etc., brings the total to an estimated $565,000.

Garage Fire—Jamestown, N. Y.

By Russell W. Gieseler,
(Member N.F.P.A.).

Five persons were burned, one of them fatally and another has died since, in a gasoline explosion and fire which occurred February 28, 1942, in the Down Town Garage at Jamestown, N. Y. The explosion took place while underground gasoline tanks were being filled from a tank truck through fill connections located inside the garage.

The garage was a two-story brick-joist structure used primarily for day and night automobile parking. The main entrance driveway was set off by tile and frame partition walls forming a room on either side. The space on one side was used as a news store while the other side was divided into an office and waiting room and a barber shop, which was completely partitioned off from the waiting room. Ordinary wood doors shut off these areas from the garage, and these doors were normally left open. The news store was heated by an open flame gas heater for which a small vent was provided. This store was about 33 feet from the nearest gasoline pump and tank filling connection.

There were four gasoline pumps located in the main driveway some twenty feet back from the doors, and one pump outside at the curb. Two tanks, believed to be of 1000-gallon capacity each, supplied the inside pumps and were located under the driveway, while a smaller tank for the outside pump was buried beneath the sidewalk. The filling connections for the larger tanks were also located inside the garage some twenty feet back from the doors.

Jamestown Post-Journal.

Gasoline, handled without regard to the established standards of fire safety, is often likened to dynamite, though the purveyors of dynamite protest this invidious comparison. One man was killed, four persons injured, one of whom has died since, and valuable property destroyed in this explosion and fire at Jamestown, N. Y., on February 28, 1942. Response of the fire department was immediate, but this picture, taken before the apparatus arrived, shows how fast the fire spread.

On the afternoon of the fire, a tank truck was inside the garage, filling the tanks. One side of the entrance doors was left open for ventilation. Information as to what happened immediately prior to the explosion is somewhat confusing, but it appears possible that a tank was overfilled and gasoline ran out on the garage floor, or that fumes arising from the gasoline being delivered spread through the area. It was reported in the newspapers that the garage owner, realizing the danger, ordered the building evacuated and the fire department called, but before these orders could be carried out, an explosion occurred. The blast was felt throughout the business district, but did not disrupt the building structurally. A garage employee was fatally burned and four others, including the truck driver, garage proprietor, and news store employee, suffered less serious burns, although one, a visitor in the news store, has died since, possibly as a consequence of his burns.

At the moment of the explosion, the chief of the fire department and his driver were in their car a half-block distant, waiting for a traffic signal to change. The chief instantly used the police radio with which the car was equipped, to summon fire apparatus and ambulances. They were among the first persons on the scene and succeeded in rescuing one of the victims who was trapped in the news store.

The source of ignition of the gasoline fumes, which spread close to the floor because of the high humidity, cannot be definitely assigned. Possible sources include the open flame gas heater in the news store, a gas water heater about 38 feet from the nearest gasoline pump and filling connection, the starting of an automobile, a tool dropped by some workman, or a cigarette in the hand of someone in the garage.

The resulting fire spread quickly to the automobiles in the near-by greasing and washing rack area, and ignited the joisted second floor in this area. Cars on the second floor were also involved after a portion of that floor collapsed. Prompt response of the fire department permitted effective rescue work and checked the spread of the fire. The tank truck, in the center of the fire, was cooled by hose streams, and by this means a second explosion was probably averted.

Of the sixty-seven motor vehicles in the garage when the explosion occurred, nine were destroyed and only ten escaped some damage. One of those destroyed had been driven only a few miles after release by the Rationing Board on the previous day. Loss to the building and contents has been estimated at $75,000.

The several factors responsible for this explosion and fire were all chargeable to definite violations of well-recognized principles of fire safety, clearly set forth in the N.F.P.A. published standards. While the construction of the building did not conform to the minimum requirements of the N.F.P.A. standard for garages, the primary responsibility for the explosion must be charged to the inside tank filling connections. Such connections to gasoline tanks are not permitted under the terms of the N.F.P.A. Suggested Flammable Liquids Ordinance, and they constitute so severe a hazard that no oil distributor should permit its tank trucks to use them. Refusal to fill gasoline tanks through inside connections would soon result in their elimination. The presence of an open flame gas water heater in the garage was contrary to established principles of fire safety. The news store and barber shop should have been cut off from the garage area by fire walls. Lacking this protection, the use of an unapproved open flame gas heater in the news store constituted a severe hazard.

Fire Record of Cities, 1941.

The following tabulation prepared by the N.F.P.A. Department of Fire Record gives 1941 fire record data for cities in the United States and Canada which have populations of over 25,000. Blanks in the tabulation indicate that the cities do not report these figures or have not responded to requests for their reports. The only cities of more than 100,000 population for which 1941 fire loss figures could not be obtained were San Francisco, which has not reported its fire losses for many years, St. Louis and Scranton.

The questionnaire sent to the various cities specifically asked that the city fire loss data reported include both insured and uninsured losses, and that both chimney and roof fires be included in the number of building fires. However, reports of the cities are not all compiled on a uniform basis. Differences in methods of determining or estimating fire losses, and in differentiating between alarms and building fires, should be considered in any use of these figures for comparison between cities.

In addition to the 1941 fire records of individual cities, this survey provides a good picture of the fire experience of the United States and Canadian cities as a group. Three hundred and ninety United States cities having over 25,000 population, according to the 1940 U. S. Census, reported a fire loss for the year 1941 of $124,790,152, amounting to an average loss per person of $2.23 for the 51,426,682 inhabitants of this group of cities. Thirty-four Canadian cities reported a total loss of $9,136,259.

A total of 376 U. S. cities reported both loss data and the number of building fires. The average loss per building fire in these cities for the year 1941 was $576. The average loss per building fire for 34 Canadian cities reporting both losses and number of fires was $497. The total number of building fires reported by 379 U. S. cities was 186,154, an average of 3.61 per 1000 population. Thirty-four Canadian cities reported 18,322 building fires.

1941 Fire Losses, Cities of 25,000 Population or Over.

City	1940 Population	Total Loss	No. Alarms	No. Bldg. Fires	Bldg. Fires per 1000 Population
Alabama					
Anniston	25,523	$22,731	381	275	10.8
Birmingham	267,583	428,053	3,107	1,199	4.5
Gadsden	36,975	12,317	486	213	5.8
Mobile	78,720	70,849	1,625	973	12.4
Montgomery	78,084	143,671	440	351	4.5
Tuscaloosa	27,493	20,308	241	143	5.2
Arizona					
Phœnix	65,414	39,335	574	304	4.7
Tucson	36,818	223,000a	300	130	3.5

a. Estimated.

City	1940 Population	Total Loss	No. Alarms	No. Bldg. Fires	Bldg. Fires per 1000 Population
Arkansas					
Fort Smith	36,584	287,510	576	167	4.6
Little Rock	88,039	173,050	1,373	....	....
California					
Alameda	36,256	27,086	293	82	2.3
Alhambra	38,935	....	....	....	....
Bakersfield	29,252	82,144	369	73	2.5
Berkeley	85,547	85,219	777	314	3.7
Beverly Hills	26,823	76,939	194	75	2.8
Burbank	34,337	19,657	498	136	4.0
Fresno	60,685	60,915	386	130	2.1
Glendale	82,582	28,435	565	121	1.5
Huntington Park	28,648	24,777	184	65	2.3
Inglewood	30,114	7,773	198	52	1.7
Long Beach	164,271	97,651	1,289	368	2.2
Los Angeles	1,504,277	2,444,550	16,096	....	....
Oakland	302,163	278,227	3,104	1,087	3.6
Pasadena	81,864	54,270	508	162	2.0
Riverside	34,696	8,553	321	81	2.3
Sacramento	105,958	181,205	1,169	381	3.6
San Bernardino	43,646	188,963	489	130	3.0
San Diego	203,341	81,761	2,294	611	3.0
San Francisco	634,536	....	8,595	2,845	4.5
San Jose	68,457	38,388	443	269	3.9
Santa Ana	31,921	19,480	218	80	2.5
Santa Barbara	34,958	62,224	351	114	3.2
Santa Monica	53,500	24,198	366	192	3.6
South Gate	26,945	16,021	343	68	2.5
Stockton	54,714	96,460a	814	209	3.8
Colorado					
Colorado Springs	36,789	8,008	267	126	3.4
Denver	322,412	492,567	3,045	1,424	4.4
Pueblo	52,162	15,421	660	428	8.1
Connecticut					
Bridgeport	147,121	510,412	1,606	566	3.8
Bristol	30,167	108,986	440	102	3.4
Greenwich	35,509	194,257	595	127	3.5
Hartford	166,267	239,689	1,865	701	4.2
Meriden	39,494	240,213	515	169	4.3
Middletown	26,495	303,552	217	128	4.9
New Britain	68,685	382,729	867	199	2.9
New Haven	160,605	566,171	2,195	733	4.6
New London	30,456	120,746	536	158	5.3
Norwalk	39,849	89,857	587	186	4.6
Stamford	47,938	81,801	616	177	3.7

a. Estimated.

City	1940 Population	Total Loss	No. Alarms	No. Bldg. Fires	Bldg. Fires per 1000 Population
Connecticut (Cont'd)					
Torrington	26,988	16,959b	309	114	4.2
Waterbury	99,314	226,267	1,789	459	4.6
West Hartford	33,776	35,309a	445	133	3.9
West Haven	30,021	....	....	....	....
Delaware					
Wilmington	111,432	177,048	1,012	527	4.6
District of Columbia					
Washington	663,091	705,929	7,789	2,443	3.7
Florida					
Jacksonville	173,065	1,016,819	2,007	1,660	9.6
Miami	172,172	136,440c	2,590	435	2.5
Miami Beach	28,012	12,778	307	68	2.4
Orlando	36,736	28,293	326	61	1.6
Pensacola	37,449	52,510	674	....	....
St. Petersburg	60,812	70,277	189	139	2.3
Tampa	108,391	150,201	971	....	....
West Palm Beach	33,693	9,976	259	92	2.7
Georgia					
Atlanta	302,288	248,003	5,027	1,137	3.7
Augusta	65,919	172,218	953	....	....
Columbus	53,280	....	....	....	....
Macon	57,865	78,146	623	345	6.0
Rome	26,282	24,852	486	248	9.4
Savannah	95,996	107,147	1,077	675	7.0
Idaho					
Boise	26,130	11,770	272	162	6.2
Illinois					
Alton	31,255	168,882	319	187	6.0
Aurora	47,170	67,755	587	236	5.0
Belleville	28,405	11,486	308	81	2.8
Berwyn	48,451	5,185	319	85	1.7
Bloomington	32,868	55,412	381	175	5.3
Chicago	3,396,808	5,240,000a	27,103	....	....
Cicero	64,712	46,965	556	153	2.4
Danville	36,919	52,727	548	212	5.7
Decatur	59,305	51,551	528	260	4.4
East St. Louis	75,609	30,800	939	....	....
Elgin	38,333	29,206	285	114	3.0
Evanston	65,389	81,035	536	251	3.8
Galesburg	28,876	28,850	266	150	5.2
Joliet	42,365	187,474	551	184	4.3
Maywood	26,648	23,971	197	85	3.2
Moline	34,608	18,421	366	58	1.7

a. Estimated. b. Insurance loss only. c. Fiscal year ending June 30, 1941.

City	1940 Population	Total Loss	No. Alarms	No. Bldg. Fires	Bldg. Fires per 1000 Population
Illinois (Cont'd)					
Oak Park	66,015	39,992	448	227	3.4
Peoria	105,087	117,677	907	526	5.0
Quincy	40,469	34,229	465	321	8.0
Rockford	84,637	53,776	1,058	339	4.0
Rock Island	42,775	20,194	354	159	3.7
Springfield	75,503	134,477	815	384	5.1
Waukegan	34,241	56,035	455	174	5.1
Indiana					
Anderson	41,572	23,768	768	390	9.4
East Chicago	54,637	230,475	583	79	1.5
Elkhart	33,434	22,126	418	226	6.7
Evansville	97,062	289,476	1,372	501	5.2
Fort Wayne	118,410	48,611	1,876	363	3.1
Gary	111,719	112,450a	1,450	640	5.7
Hammond	70,184	60,831	784	292	4.2
Indianapolis	386,972	750,000a	3,997	2,389	6.1
Kokomo	33,795	36,234	442	302	9.1
Lafayette	28,798	13,000	420	42	1.4
Marion	26,767	43,938	435	196	7.3
Michigan City	26,476	12,162	276	130	4.9
Mishawaka	28,298	21,094	340	149	5.3
Muncie	49,720	70,192	801	387	7.8
New Albany	25,414	40,932	477	303	11.9
Richmond	35,147	29,785	483	303	8.6
South Bend	101,268	111,773	1,541	605	6.0
Terre Haute	62,693	52,573	685	400	6.4
Iowa					
Burlington	25,832	21,636	512	75	2.9
Cedar Rapids	62,120	27,536	525	276	4.4
Clinton	26,270	24,110	319	280	10.6
Council Bluffs	41,439	31,487	447	244	5.9
Davenport	66,039	126,680	581	111	1.7
Des Moines	159,819	251,077	2,011	730	4.6
Dubuque	43,892	37,842	674	522	11.9
Mason City	27,080	132,631a	290	128	4.7
Ottumwa	31,570	134,127	385	264	8.3
Sioux City	82,364	61,693	781	329	4.0
Waterloo	51,743	99,925	639	280	5.4
Kansas					
Hutchinson	30,013	10,190	329	135	4.5
Kansas City	121,458	73,054	1,410	570	4.7
Topeka	67,833	120,973	810	277	4.1
Wichita	114,966	188,157	1,417	552	4.8
Kentucky					
Ashland	29,537	43,468	265	197	6.7

a. Estimated.

City	1940 Population	Total Loss	No. Alarms	No. Bldg. Fires	Bldg. Fires per 1000 Population
Kentucky (Cont'd)					
Covington	62,018	21,037	604	532	8.6
Lexington	49,304	56,125	732	581	11.7
Louisville	319,077	304,385	3,244	1,475	4.6
Newport	30,631	8,083	263	73	2.4
Owensboro	30,245	67,177	391	136	4.5
Paducah	33,765	101,640	709	....	....
Louisiana					
Alexandria	27,066	130,280	414	194	7.2
Baton Rouge	34,719	44,841	452	36	1.0
Monroe	28,309	28,730	529	65	2.3
New Orleans	494,537	1,706,773a	2,291	995	2.0
Shreveport	98,167	193,623	936	357	3.6
Maine					
Bangor	29,822	61,036	741	595	19.9
Lewiston	38,598	70,384	1,453	555	14.4
Portland	73,643	233,362	1,809	381	5.2
Maryland					
Baltimore	859,100	1,836,289	10,976	5,067	5.8
Cumberland	39,483	52,025	508	203	5.1
Hagerstown	32,491	....	....	....	....
Massachusetts					
Arlington	40,013	40,286	769	56d	1.4
Belmont	26,867	81,345	500	130	4.7
Beverly	25,537	51,082	1,062	213	8.4
Boston	770,816	4,555,108e	12,414	4,562	5.9
Brockton	62,343	380,000	1,839	475	7.6
Brookline	49,786	94,274	858	578	11.6
Cambridge	110,879	222,073	2,168	912	8.2
Chelsea	41,259	226,641	1,045	171	4.1
Chicopee	41,664	71,298	803	192	4.6
Everett	46,784	151,618	1,062	172	3.7
Fall River	115,428	14,366,363	1,488	394	3.4
Fitchburg	41,824	154,342	823	355	8.5
Haverhill	46,752	293,671	1,133	203	4.3
Holyoke	53,750	106,423	962	507	9.4
Lawrence	84,323	663,260	1,375	314	3.7
Lowell	101,389	192,465	1,713	397	3.9
Lynn	98,123	580,000a	2,298	596	6.1
Malden	58,010	127,389	1,164	249	4.3
Medford	63,083	78,366	1,010	153	2.4
Melrose	25,333	59,143	495	74	2.9
New Bedford	110,341	78,496	1,202	448	4.1
Newton	69,873	98,066	1,510	262	3.7

a. Estimated. d. Fires with loss. e. Insurance loss only.

City	1940 Population	Total Loss	No. Alarms	No. Bldg. Fires	Bldg. Fires per 1000 Population
Massachusetts (Cont'd)					
Pittsfield	49,684	83,257	686	200	4.0
Quincy	75,810	402,009	2,078	423	5.6
Revere	34,405	65,342	950	126	3.7
Salem	41,213	91,066	968	199	4.8
Somerville	102,177	210,466	1,292	429	4.2
Springfield	149,554	235,000a	2,340	514	3.4
Taunton	37,395	50,948	960	318	8.5
Waltham	40,020	133,991	841	191	4.7
Watertown	35,427	55,072	576	65	1.8
Worcester	193,694	531,789a	4,418	1,302	6.8
Michigan					
Ann Arbor	29,815	40,303	406	107	3.6
Battle Creek	43,453	45,085	281	210	....
Bay City	47,956	35,825	838	236	4.9
Dearborn	63,584	112,025	506	210	3.3
Detroit	1,623,452	2,860,033a	15,194	7,040	4.3
Flint	151,543	192,203	1,770	948	6.2
Grand Rapids	164,292	172,673	1,255	364	2.2
Hamtramck	49,839	181,435	427	305	6.1
Highland Park	50,810	44,111	551	244	4.7
Jackson	49,656	171,095	718	381	7.7
Kalamazoo	54,097	54,356	690	313	5.8
Lansing	78,753	109,446	993	249	3.2
Muskegon	47,697	62,401	540	261	5.5
Pontiac	66,626	102,838	665	386	5.8
Port Huron	32,759	49,298	580	237	7.2
Royal Oak	25,087	....	....	....	....
Saginaw	82,794	172,313	988	403	4.9
Wyandotte	30,618	41,922	319	139	4.5
Minnesota					
Duluth	101,065	315,418	941	....	....
Minneapolis	492,370	944,170	3,407	922	1.9
Rochester	26,312	143,528a	364	187	7.1
St. Paul	287,736	541,297	2,897	951	3.3
Mississippi					
Jackson	62,107	106,674	629	263	4.3
Meridian	35,481	136,435	519	255	7.2
Missouri					
Joplin	37,144	28,935	834	321	8.7
Kansas City	399,178	733,053	4,661	1,760	4.4
St. Joseph	75,711	65,633	1,065	321	4.2
St. Louis	816,048	....	....	....	....
Springfield	61,238	55,086	1,001	458	7.5

a. Estimated.

City	1940 Population	Total Loss	No. Alarms	No. Bldg. Fires	Bldg. Fires per 1000 Population
Missouri (Cont'd)					
University City	33,023	16,682	527	127	3.8
Montana					
Butte	37,081	31,838	295	126	3.4
Great Falls	29,928	31,370	234	34	1.1
Nebraska					
Lincoln	81,984	67,340	781	311	3.8
Omaha	223,844	270,000	2,211	900	4.0
New Hampshire					
Concord	27,171	39,286	598	433	16.3
Manchester	77,685	130,000a	1,229	495	6.4
Nashua	32,927	69,264	692	397	12.0
New Jersey					
Atlantic City	64,094	38,851a	685	359	5.6
Bayonne	79,198	91,561	1,032	382	4.8
Belleville	28,167	18,626	357	29	1.3
Bloomfield	41,623	40,227	548	125	3.0
Camden	117,536	236,900	1,514	476	4.0
Clifton	48,827	130,971	710	88	1.8
East Orange	68,945	32,990	530	199	2.9
Elizabeth	109,912	102,121	944	362	3.3
Garfield	28,044	9,630	66	31	1.1
Hackensack	26,279	16,816	417	106	4.0
Hoboken	50,115	....	....	....	....
Irvington	55,328	52,010	318	280	5.0
Jersey City	301,173	2,692,698	2,494	1,226	4.1
Kearny	39,467	63,315	425	121	3.1
Montclair	39,807	42,351	478	217	5.4
Newark	429,760	920,389	4,276	1,492	3.5
New Brunswick	33,180	41,805	436	152	4.6
North Bergen Twp.	39,714	7,192	508	76	1.9
Orange	35,717	30,852	266	77	2.1
Passaic	61,394	199,960	514	234	3.8
Paterson	139,656	450,295	1,210	621	4.4
Perth Amboy	41,242	543,310	186	81	2.0
Plainfield	37,469	15,476	558	121	3.2
Teaneck Twp.	25,275	45,549	710	110	4.3
Trenton	124,697	320,118	1,132	477	3.8
Union City	56,173	78,460	649	219	3.9
West New York	39,439	27,172	344	111	2.8
West Orange	25,662	....	....	....	....
Woodbridge	27,191	....	....	....	....
New Mexico					
Albuquerque	35,449	16,552	266	140	4.0
New York					
Albany	130,577	152,597	1,840	722	5.5

a. Estimated.

City	1940 Population	Total Loss	No. Alarms	No. Bldg. Fires	Bldg. Fires per 1000 Population
New York (Cont'd)					
Amsterdam	33,329	144,482	288	281	8.4
Auburn	35,753	26,843	373	145	4.0
Binghamton	78,309	113,293	601	231	2.9
Buffalo	575,901	807,884	4,149	1,309	2.3
Elmira	45,106	45,585	406	184	4.1
Jamestown	42,638	100,339	560	219	5.1
Kingston	28,589	20,886	406	166	5.8
Mount Vernon	67,362	102,219	476	165	2.4
Newburgh	31,883	26,003	267	129	4.1
New Rochelle	58,408	80,096	538	192	3.3
New York City	7,454,995	9,843,671	33,367	....	....
Niagara Falls	78,029	116,302	1,054	252	3.2
Poughkeepsie	40,478	59,445	454	171	4.2
Rochester	324,975	384,803	3,058	868	2.7
Rome	34,214	34,544	428	168	4.9
Schenectady	87,549	91,140	985	268	3.1
Syracuse	205,967	330,988	1,757	607	2.9
Troy	70,304	82,194	985	492	7.0
Utica	100,518	120,673	769	242	2.4
Watertown	33,385	98,262	406	133	4.0
White Plains	40,327	17,734	480	128	3.1
Yonkers	142,598	214,407	1,686	580	4.1
North Carolina					
Asheville	51,310	162,872	711	55	1.0
Charlotte	100,899	208,702	2,133	918	9.1
Durham	60,195	36,624	628	162	2.7
Greensboro	59,319	92,778	960	210	3.5
High Point	38,495	80,379	583	210	5.5
Raleigh	46,897	45,116	673	597	12.7
Rocky Mount	25,568	9,239	224	118	4.6
Wilmington	33,407	117,963	646	....	....
Winston-Salem	79,815	91,791	951	164	2.1
North Dakota					
Fargo	32,580	171,393	199	164	5.0
Ohio					
Akron	244,791	204,954a	2,496	964	3.8
Canton	108,401	101,485	865	261	2.4
Cincinnati	455,610	591,237	4,394	1,586	3.4
Cleveland	878,336	2,864,728	9,338	3,723	4.2
Cleveland Heights	54,992	26,855	710	123	2.2
Columbus	306,087	333,899	5,081	1,754	5.7
Dayton	210,718	299,988	2,715	1,384	6.5
East Cleveland	39,495	25,891	293	96	2.4
Elyria	25,120	57,429	268	89	3.5
Hamilton	50,592	80,529	651	378	7.5

a. Estimated.

City	1940 Population	Total Loss	No. Alarms	No. Bldg. Fires	Bldg. Fires per 1000 Population
Ohio (Cont'd)					
Lakewood	69,160	19,512	237	91	1.3
Lima	44,711	28,980	603	225	5.0
Lorain	44,125	36,228	503	110	2.5
Mansfield	37,154	110,190	270	174	4.7
Marion	30,817	36,692	308	167	5.4
Massillon	26,644	29,513	169	63	2.3
Middletown	31,220	59,202	383	250	8.0
Newark	31,487	16,368	330	148	4.7
Norwood	34,010	17,797	250	111	3.3
Portsmouth	40,466	25,402	410	212	5.2
Springfield	70,662	32,987	738	445	6.3
Steubenville	37,651	194,898	375	200	5.2
Toledo	282,349	459,575a	2,640	1,120	4.0
Warren	42,837	29,793	500	222	5.2
Youngstown	167,720	176,313	1,824	822	4.9
Zanesville	37,500	38,746	423	152	4.0
Oklahoma					
Enid	28,801	10,371	251	78	2.8
Muskogee	32,332	26,994	697	365	11.3
Oklahoma City	204,424	84,495	2,130	427	2.0
Tulsa	142,157	101,682	2,335	498	3.5
Oregon					
Portland	305,394	1,005,700	3,982	2,953	9.7
Salem	30,908	13,882	355	....	....
Pennsylvania					
Aliquippa	27,023	9,667	181	40	1.5
Allentown	96,904	86,503	387	244	2.5
Altoona	80,214	65,100	656	569	7.1
Bethlehem	58,490	155,542	256	121	2.1
Chester	59,285	480,925	287	227	3.8
Easton	33,589	48,035	178	104	3.1
Erie	116,955	96,790	1,113	460	2.7
Harrisburg	83,893	88,915	553	270	3.2
Hazelton	38,009	49,524	140	70	1.8
Johnstown	66,668	107,096	676	331	4.9
Lancaster	61,345	72,651	305	140	2.4
Lebanon	27,206	9,877	63	55	2.0
McKeesport	55,355	17,587	400	214	3.9
New Castle	47,638	85,062	437	138	2.9
Norristown	38,181	147,665	171	118	3.1
Philadelphia	1,931,334	4,938,478	13,339	4,441	2.3
Pittsburgh	671,659	443,518	5,878	2,595	3.9
Reading	110,568	87,641	524	308	2.8
Scranton	140,404	....	....	....	....

a. Estimated.

City	1940 Population	Total Loss	No. Alarms	No. Bldg. Fires	Bldg. Fires per 1000 Population
Pennsylvania (Cont'd)					
Sharon	25,622	32,610	263	57	2.2
Washington	26,166	15,436	219	126	4.8
Wilkes-Barre	86,236	111,648	473	184	2.1
Wilkinsburg	29,853	18,375	214	97	3.2
Williamsport	44,355	98,300	310	173	3.9
York	56,712	20,952	247	161	2.8
Rhode Island					
Central Falls	25,121	30,535	272	96	3.8
Cranston	47,173	63,036	1,155	136	2.9
East Providence	32,093	39,650	921	134	4.2
Newport	30,402	47,730	343	245	8.1
Pawtucket	75,449	77,543	1,328	263	3.5
Providence	253,214	480,183	3,913	709	2.8
Woonsocket	49,204	80,228	....	189	3.8
South Carolina					
Charleston	71,275	66,344	800	500	7.0
Columbia	62,396	59,858	1,001	421	6.8
Greenville	34,734	....	472	320	9.2
Spartanburg	32,249	40,086	512	283	8.8
South Dakota					
Sioux Falls	40,832	166,110a	386	133	3.2
Tennessee					
Chattanooga	128,163	200,965	1,732	719	5.6
Johnson City	25,353	31,325	373	116	4.6
Knoxville	111,580	126,277	1,426	612	5.8
Memphis	292,942	425,000a	3,184	1,195	4.1
Nashville	167,402	542,948	3,331	884	5.3
Texas					
Abilene	26,612	....	....	....	....
Amarillo	51,686	33,002	400	287	5.5
Austin	87,930	88,345	1,145	325	3.7
Beaumont	59,061	62,433	707	602	....
Corpus Christi	57,301	162,147	747	228	4.0
Dallas	294,734	927,372	....	559	1.9
El Paso	96,810	....	600	....	....
Fort Worth	177,662	331,870	3,119	905	5.1
Galveston	60,862	93,635	568	223	3.7
Houston	384,514	434,000a	3,479	1,402	3.6
Laredo	39,274	8,044	186	74	1.9
Lubbock	31,853	76,200	267	....	....
Port Arthur	46,140	52,728	281	151	3.3
San Angelo	25,802	50,314	432	112	4.3
San Antonio	253,854	98,738a	2,188	646	2.5
Tyler	28,279	129,711	552	101	3.6

a. Estimated.

City	1940 Population	Total Loss	No. Alarms	No. Bldg. Fires	Bldg. Fires per 1000 Population
Texas (Continued)					
Waco	55,982	75,000	568	294	5.2
Wichita Falls	45,112	....	....	....	....
Utah					
Ogden	43,688	83,926	663	152	3.5
Salt Lake City	149,934	638,554	1,650	....	....
Vermont					
Burlington	27,686	....	541	323	11.7
Virginia					
Alexandria	33,523	....	....	....	....
Danville	32,749	93,423	417	144	4.3
Lynchburg	44,541	108,065	903	337	7.6
Newport News	37,067	76,129	772	353	9.5
Norfolk	144,332	768,244	3,324	1,244	8.6
Petersburg	30,631	101,510	435	247	8.1
Portsmouth	50,745	62,259	918	301	5.9
Richmond	193,042	227,697	3,023	1,435	7.4
Roanoke	69,287	97,344	977	308	4.5
Washington					
Bellingham	29,314	42,078	557	234	8.0
Everett	30,224	34,698	590	406	13.4
Seattle	368,302	521,911	4,399	2,305	6.3
Spokane	122,001	417,285	1,393	643	5.3
Tacoma	109,408	109,421	2,012	950	8.7
Yakima	27,221	105,194	291	125	4.6
West Virginia					
Charleston	67,914	125,171	678	255	3.8
Clarksburg	30,579	6,244	255	231	7.6
Huntington	78,836	111,033	1,039	296	3.7
Parkersburg	30,103	6,522	279	59	2.0
Wheeling	61,099	290,178	591	386	6.3
Wisconsin					
Appleton	28,436	36,413	310	173	6.1
Beloit	25,365	11,615	402	229	9.0
Eau Claire	30,745	39,813	424	218	7.1
Fond du Lac	27,209	24,468a	259	137	5.0
Green Bay	46,235	41,158	364	197	4.3
Kenosha	48,765	39,234	602	238	4.9
La Crosse	42,707	47,797	392	270	6.3
Madison	67,447	31,349	683	551	8.2
Milwaukee	587,472	526,086	4,737	1,871	3.2
Oshkosh	39,089	23,447	314	195	5.0
Racine	67,195	46,713	425	267	4.0
Sheboygan	40,638	25,115	330	223	5.5
Superior	35,136	47,256	520	215	6.1
Wausau	27,268	38,955	497	237	8.7
Wauwatosa	27,769	6,878a	173	81	2.9
West Allis	36,364	19,310	367	76	2.1

a. Estimated.

1941 Fire Losses, Canadian Cities.

City	Population	Total Loss	No. Alarms	No. Bldg. Fires	Bldg. Fires per 1000 Population
Alberta					
Calgary	85,726	$334,850	678	89	1.0
Edmonton	91,723	273,903	1,032	347	4.4
British Columbia					
Vancouver	360,000	278,978	2,519	1,411	3.9
Victoria	49,000	69,134	543	274	5.6
Manitoba					
Winnipeg	224,252	360,665	2,868	1,964	8.8
New Brunswick					
St. John	50,000	1,383,028	742	542	10.8
Nova Scotia					
Glace Bay	25,000	44,177	80	63	2.5
Halifax	90,000	153,569	869	237	2.6
Sydney	25,000	240,000a	390	106	4.2
Ontario					
Brantford	31,526	20,817	381	59	1.9
East York Twp.	38,182	6,041	228	82	2.1
Fort William	26,251	33,339	333	301	11.0
Hamilton	155,836	351,448	1,381	680	3.4
Kirkland Lake	25,000	13,463	304	45	1.8
Kitchener	33,000	23,637	165	63	1.9
London	78,000	63,900	699	294	3.8
Oshawa	26,370	26,378	246	150	5.7
Ottawa	159,264	509,487a	2,016	1,071	6.7
St. Catharines	27,800	24,452	247	134	4.8
Sault Ste. Marie	25,283	139,947	248	46	1.8
Sudbury	32,371	34,758	401	337	10.3
Timmins	27,000	18,897	406	383	14.2
Toronto	649,123	1,630,824	4,716	2,599	4.0
Windsor	103,567	59,869	893	420	4.1
York Twp.	77,000	....	....	....	....
Quebec					
Hull	30,909	28,931	900	506	16.3
Montreal	1,286,388	2,030,081	7,115	2,058	1.5
Quebec	150,000	650,846	3,085	2,355	1.5
Sherbrooke	34,000	78,953	756	289	8.5
Three Rivers	42,000	88,554	617	504	12.0
Outremont	31,000	61,790	227	46	1.5
Verdun	65,000	30,270	338	202	3.1
Westmount	26,000	29,500	242	104	4.0
Saskatchewan					
Regina	60,000	17,611	437	292	4.9
Saskatoon	41,690	24,162	495	269	6.5

a. Estimated.

Conflagrations in America Since 1914.*

The danger of a wide-spreading fire, commonly termed a conflagration, exists in varying degree in practically every city and town in the United States and Canada. The following record of the principal conflagrations occurring in these two countries since the burning of Salem, Massachusetts, in 1914, together with a summary of the larger fire disasters occurring before that date, serves to call attention to the importance of the conflagration as perhaps the most serious element in the national fire waste. A single conflagration can exceed in fire loss the total annual loss for a year and can have most disastrous consequences.

The conditions which have made past conflagrations possible exist today to a large extent, accentuated by the possibility of an incendiary bombing attack. Although modern protective equipment and improved construction are gradually reducing the likelihood of one, a combination of unfavorable circumstances, such as drought conditions, interruption of water supplies, or a series of simultaneous fires, set either accidentally or by air attack, can produce devastating results.

The infrequency of conflagrations in any one locality tends to give municipal officials as well as the public a false sense of security. The possibility of tragic consequences resulting from a widespread fire makes it imperative that in every community attention be given to elimination of conditions which may breed a conflagration.

There is no universally accepted, exact definition of a conflagration. Some authorities have listed as such all fires causing more than a specified amount of loss, irrespective of the number of buildings involved. However, the general practice is to apply the term only to fires extending over a considerable area and destroying numbers of buildings. Fire in a group of buildings all belonging to a single industrial plant is not usually considered a conflagration even though the area and values involved may be considerable. This record is limited to the special type of fire commonly regarded as a conflagration and excludes individual fires regardless of their magnitude. Likewise, forest fires have not been included except in instances where they spread to and destroyed built-up communities, because they present a problem outside the scope of this treatment.

Table I lists seventy-nine conflagrations that have occurred in the United States and Canada since the burning of Salem, Massachusetts, on June 25, 1914. These have been selected as the outstanding conflagrations during this

*This record supersedes "100 Conflagrations Since 1900," a reprint from the QUARTERLY, October, 1935.

"WITH ALL MY WORLDLY GOODS" — **Salem, Massachusetts, June 25, 1914. The fire started in a frame factory building in the middle of the residential district. Wooden shingle roofs spread it until 1600 buildings had been leveled with a loss of $14,000,000. The ruins of the Naumkeag Mills, the largest cotton mill in the world at the time, may be seen in the background.**

period, considered on the basis of character and extent, as well as amount of loss. Lessons of value in *modern* fire protection have thus been suggested in both text and illustrations. Many of the fires analyzed occurred in small communities, and while not given national prominence were nevertheless major catastrophes to the the particular locality concerned. Numerous group fires, often popularly referred to as conflagrations, have not been included.

The factors listed as responsible for the conflagrations in this record are those contributing to the spread of fire beyond the building or immediate area of origin; a conflagration has not been considered as such until it was spreading through a group of buildings beyond control. For this reason, the cause of the fire in the building of origin and its extension from the incipient stage to involve the entire building are not discussed here. Large area buildings of combustible construction, often with highly combustible contents, and without automatic sprinkler protection, have been primarily responsible for a large number of extensive fires. The removal of such structures or their complete protection by automatic sprinklers might to a notable degree eliminate the danger of city conflagrations.

Conflagrations prior to 1914 have not been analyzed in this record, as conditions have so changed that the circumstances of such fires are of limited significance in respect to the study of present conflagration possibilities. A brief reference has been made, however, in Table II and in several illustrations, to some of the great American fires of the past century because of their historical importance.

Characteristics of Conflagrations.

Conflagrations have been of three general types. These are: fires starting in hazardous occupancies or fire breeders in congested sections and which spread over a constantly widening front before adequate resistance can be organized; fires occurring in residential sections which spread beyond control due to combustible construction, wooden shingle roofs, and inadequate protection facilities; and those resulting from extensive forest and brush fires entering a city over a wide frontage.

Conflagrations create terrific drafts. The heated air and gases rise and air is drawn in from the sides of the burning area so rapidly that a high wind is often reported by near-by observers while the air is relatively calm a few miles away. Frequently large pieces of burning material are carried aloft in several directions and start numerous other fires. Heated gases of combustion have been known to travel for surprising distances and then burst into flame, spreading the fire quickly. In addition, conflagrations extend horizontally by means of radiated waves of heat. Exposed buildings ignite before any fire reaches them directly. This fact makes exposure protection of utmost importance in combating conflagrations.

$14,000,000. The ruins of the Naumkeag Mills, the largest cotton mill in the world at the time, may be seen in the background.

Business District.

"*AND CATCH THE BURNING SPARKS THAT FLY*" — Paris, Texas, March 21, 1916. Sparks from a fire in a frame warehouse, a high wind, and wooden shingle roofs combined to destroy 1440 buildings, including both business and residential structures, at a loss of $11,000,000.

Residential District.

SECOND ONLY TO WAR — **Augusta, Georgia, March 22, 1916. These two fire-resistive buildings were gutted when fire entered ordinary glass windows. The flames, starting in a five-story mercantile building of inferior construction, destroyed 682 buildings with a loss of $4,250,000. Twenty thousand bales of cotton were also destroyed in this fire. The cotton, stored in the streets in the business district in violation of city ordinances, obstructed the path of fire apparatus, interfered with access to hydrants, and furnished fuel for the conflagration's rapid spread. Wooden shingle roofs and a high wind were largely responsible for its spread through the residential district. Fire apparatus from Waynesboro, Macon and Atlanta, arriving while the fire was at its height, was powerless to assist the harassed Augusta department, because the hose couplings would not fit.**

There is a popular fallacy that water may increase the intensity of conflagrations, on the theory that the tremendous heat may break up water into its constituent elements, hydrogen and oxygen, the hydrogen subsequently burning to increase the intensity of the fire. It has never been conclusively established that such dissociation of water occurs in conflagrations, and if it does the burning of the hydrogen cannot produce any more heat than was absorbed from the fire in the process of dissociation.

Conflagrations do not usually confine themselves to one fire area, but start many blazes in advance by means of flying brands. This is particularly true in cities where wooden shingle roofs are permitted. Firemen in such cities usually find, at a time when their full force should be concentrated on the main fire, that a large number of other fires have started over a wide area, often resulting in complete overtaxing of the fire protection facilities.

Fighting Conflagrations.

Conflagrations differ from ordinary fires in their spread, and fire officials should study the factors which have caused them in the past, together with the manner in which they were fought, and apply this information to local conditions. Comparatively few firemen have had experience in fighting conflagrations, and when one occurs they are frequently not prepared to meet it. Los Angeles and other progressive fire departments have prepared detailed plans for conflagrations or other major disasters. These plans contain provisions for mobilizing all units which are available and assigning specific functions to each. Besides fire-fighting forces and study of available auxiliary sources of water supply such organization plans include units to deal with public health; methods of communication; law and order; public utilities, such as water, gas electrical, and street departments; and units to provide food, shelter, and other vital relief. It will be found in a time of disaster that coördination of these various activities may be very difficult. However, in any well-organized community each department will automatically perform its own functions. Planning is chiefly necessary to provide for needed emergency equipment and to inform each agency as to what details it must cover.

Many conflagrations have practically burned themselves out, sometimes almost unimpeded by the fire department, which, due to inadequate water supplies, personnel or equipment, was forced to confine its activities to flanking the fire and following up the rear. Experience has shown that heavy streams in large numbers are essential to controlling a conflagration. Ordinary streams from hand lines are not only ineffective on a large body of fire, but it is frequently impossible for men to get near enough to use them efficiently due to the great heat. Heavy streams are necessary to reach the burning material and to form a water curtain to protect exposures from radiated heat. Even the largest fire streams do not have an effective range of much over 100 feet, and there is no possible method of applying water to the center of the burning area.

A ROOF OVER THEIR HEADS — Atlanta, Georgia, May 21, 1917. But the roof was of wooden shingles, as were countless others in the city. In all, 1938 buildings were destroyed before the flames were halted. The cost: $5,500,000.

THE SIDEWALKS OF NEW YORK — New York City, June 15, 1922. Frame dwellings, wooden shingle roofs, flying brands, inadequate water supplies. Result: A conflagration that destroyed 141 buildings at a cost of $2,000,000.

IT HAPPENED ONE NIGHT — Chicago, Illinois, March 15, 1922. Even Clinton Street, an eighty-foot wide thoroughfare, was not enough to stop this fire, which entered through the unprotected windows of the Burlington Building on the right. Thirteen buildings were burned, with a loss of $5,500,000, exclusive of losses of records.

Except in very large cities, it is impossible to maintain a fire department large enough to combat properly and unaided even a minor conflagration. Plans should be made in advance for a systematic mobilization of substantial outside aid. In such an emergency communication systems are greatly overtaxed and, unless arrangements have been made in advance, great delays in obtaining help inevitably result. All resources should be utilized. Offshift firemen should be mobilized, spare apparatus should be equipped ready for service, plans should be made for adequate policing so that right of way may be given to apparatus and crowds may not hinder fire-fighting operations. Arrangements should be made for supplying adequate fuel for all equipment. Some communities having a serious wooden shingle roof hazard maintain small apparatus with water tanks to serve as "spark chasers" so that the larger apparatus will not have to be diverted from the main fire.

The use of dynamite is often mentioned in connection with conflagrations. It should be used only by explosive experts as a last resort and as an admission of failure to control the fire by other methods. The use of dynamite makes it necessary to stop other fire-fighting operations in the vicinity. A partially demolished building is more hazardous than one which is intact. An explosion may break windows, and water and gas pipes in the area, thus aiding the fire. Only in cases where water supplies are completely interrupted, such as when an earthquake precedes the fire, can the use of explosives prove justifiable.

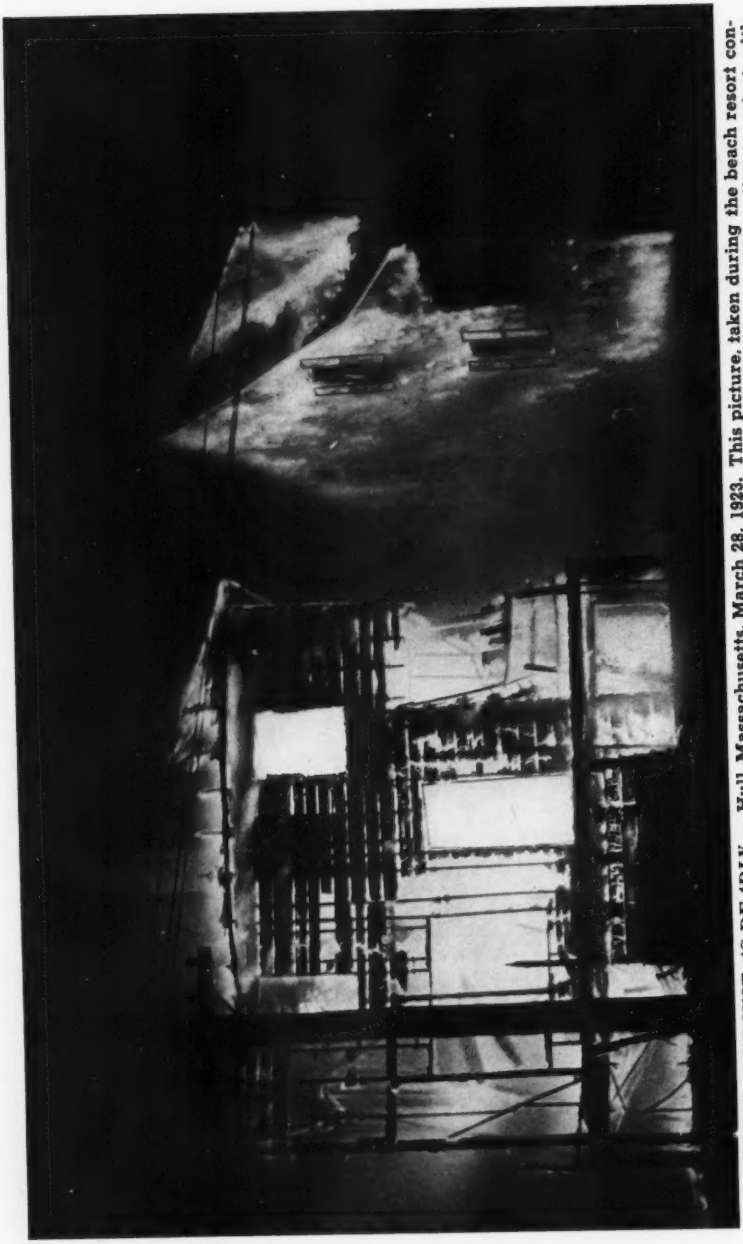
Forecasting Conflagrations.

Fire protection engineers are able to prophesy as to where conflagrations are most likely to occur. Among the conditions which invite widespread destruction by fire are congested areas lacking fire cut-offs and exposure protection, hazardous occupancies without proper protection, dilapidated fire breeding structures, and wooden shingle roofs.

Once the hazardous areas have been located and identified, it should be realized that certain weather conditions may develop any fire into conflagration proportions. Tests indicate that serious fires will occur most frequently when there is a deficiency of moisture in the air. A long dry spell with low humidity prepares combustible roofs and exposures for ignition, while high winds increase the rapidity of spread of fire.

Prevention of Conflagrations.

It is doubtful if the possibility of conflagrations and serious group fires will be entirely eliminated, particularly in the older cities, but the best authorities agree that it can be very much reduced without any great financial burden. Systematic city planning and zoning is becoming recognized as a means of prevention of future conflagrations. The segregation of hazardous manufacturing operations and removal of particularly dangerous structures from congested



UNSEEN, BUT JUST AS DEADLY — Hull, Massachusetts, March 28, 1923. This picture, taken during the beach resort conflagration that destroyed 44 buildings with a loss of $250,000, illustrates ignition by radiated heat with no direct contact with flame.

sections, provision for wide streets and park areas to facilitate fire fighting and serve as fire breaks, and isolation of fire alarm central stations are among the important items in a comprehensive city plan.*

Other means of reducing the conflagration hazard include:

(1) Requirements for a high standard of building construction for all buildings, particularly in high value districts, by means of an adequate, strictly enforced building code.

(2) The elimination of wooden shingles and other combustible roof coverings by means of a suitable ordinance.

(3) Adequate exposure protection wherever communicating fires are likely, including openings in fire-resistive buildings. Methods of protection include outside open head sprinkler protection for all wall openings, blank walls with adequate parapets above the roof for serious exposure hazard, extensive use of wired glass, metal frame window protection and shutters. Experience has shown that for serious exposure fires more than one form of protection is desirable. Wired glass windows and shutters must be closed to be effective.

(4) Conflagration breeders, the term for very dilapidated structures and those in which especially dangerous enterprises are carried on, are easily detected and should not be tolerated in high value districts. Buildings which have served their usefulness and are in a state of disrepair should be condemned and removed.

(5) General use of automatic sprinklers, particularly in high value districts and hazardous occupancies. Numerous fires are on record where sprinklers have prevented severe exposure fires from developing into conflagrations.

(6) Improved public water supplies, including elimination of small and dead-end mains. Developing auxiliary sources of water supply, such as ponds, brooks, and canals, by providing accessible locations from which fire department pumpers can take suction.

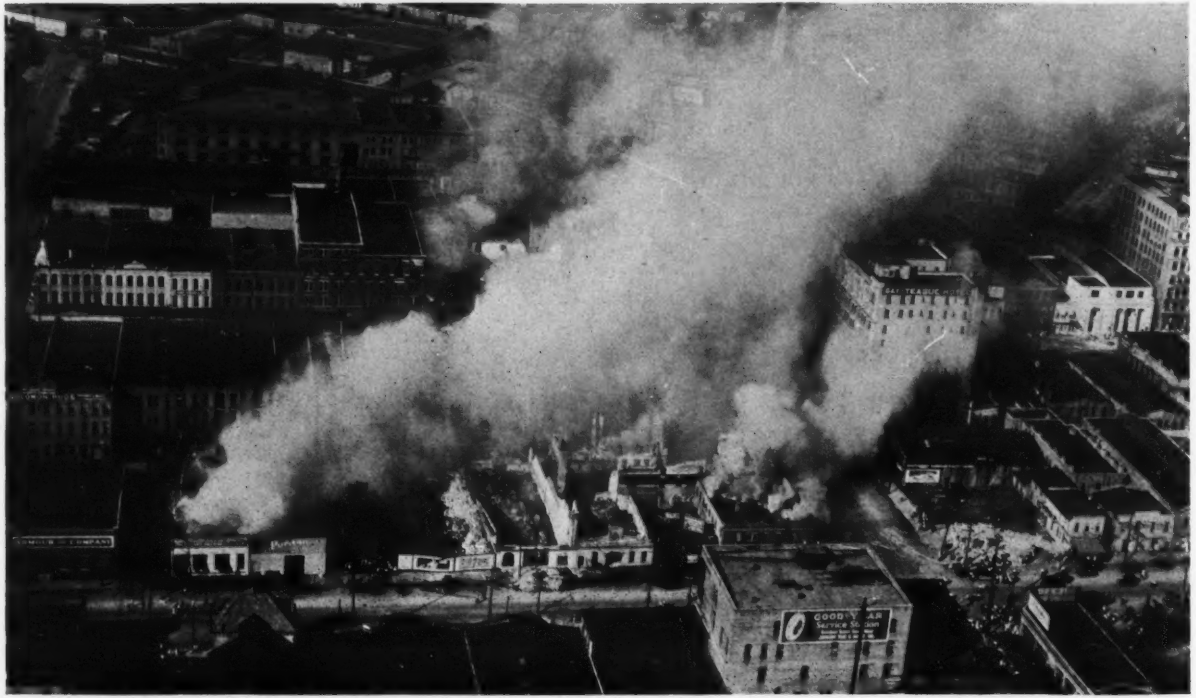
(7) Greater fire department efficiency, including improved apparatus, especially in the form of heavy stream equipment, better training of firemen and increased manpower where necessary for efficient operation.

(8) A complete municipal fire alarm system to provide for the handling of all alarms and the dispatching of apparatus without the necessity of dependence upon public telephone facilities, which are invariably severely taxed during emergencies. Automatic fire alarm installations in hazardous properties, with arrangements for the prompt response of the fire department, will make for the control of fires before they reach a stage where they may overtax available fire protection equipment.

*See N.F.P.A. brochure on City Planning and Fire Protection.

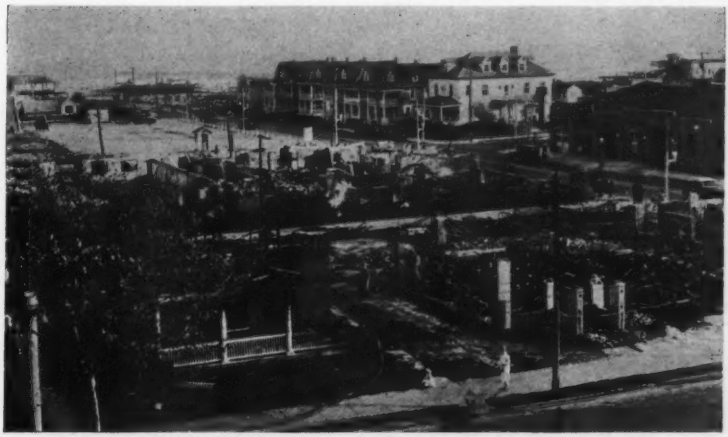
SOMEONE DIDN'T THINK — Berkeley, California, September 17, 1923. This conflagration started as a brush fire which a high wind swept toward the city over a wide front. Wooden shingle roofs were ignited in an extensive area and the fire department was seriously handicapped by inadequately sized water mains. The loss was $6,000,000.

SO NEAR, AND YET SO FAR — **Shreveport, Louisiana, September 4, 1925. Starting in a house across the street from the fire station shown in the picture, this conflagration destroyed 196 dwellings with a loss of $1,000,000. The water system was out of service because of breaks in the mains, so that the fire department could do little to check the flames.**



FIRE DOES "BUSINESS AS USUAL" — Montgomery, Alabama, June 4, 1927. Starting in a junk yard in the left foreground, this conflagration was soon quickly out of control, due to a delayed alarm and the bursting of fire hose. The sprinklered buildings in the background eventually stopped the flames, but the loss was $1,500,000.

A FIRE DID THAT? — Ocean City, New Jersey, October 11, 1927. From a theatre on the boardwalk this fire spread to cover four city blocks and bring more than $810,000 worth of destruction. View taken from the approximate point of origin of the conflagration.



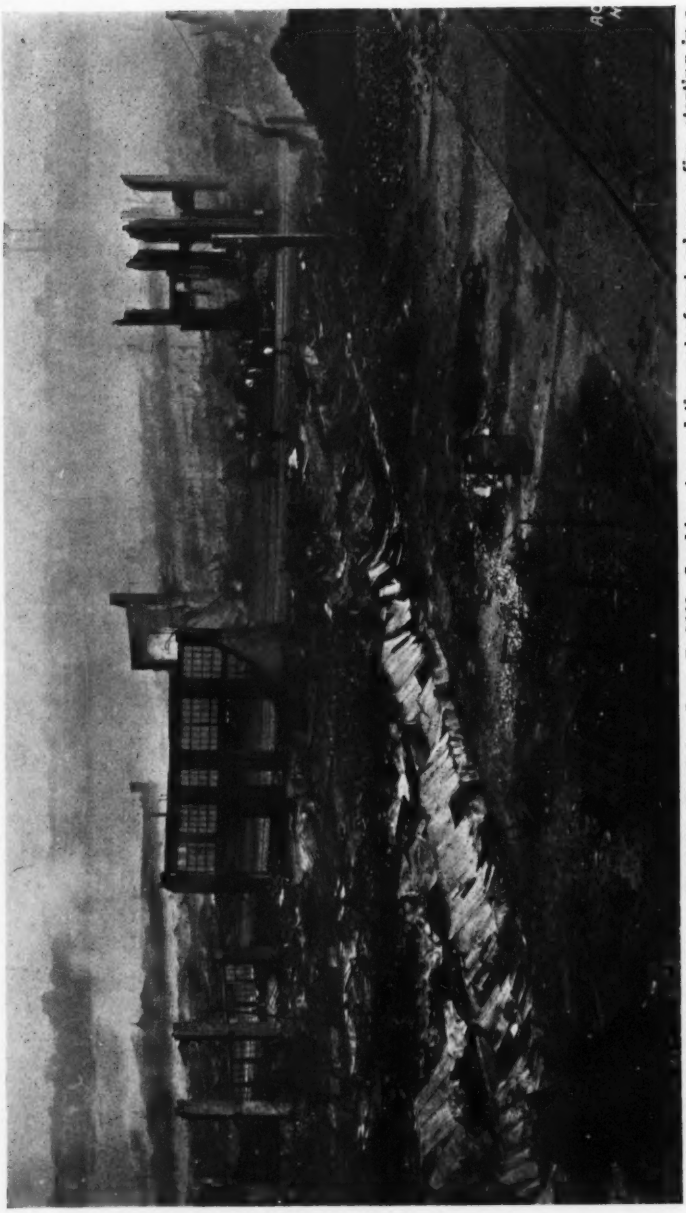
The ruins of nine buildings more than a block distant from the main conflagration. These buildings were destroyed because of their wooden shingle roofs, which were ignited by sparks that flew over the row of houses in the middle background.

STREET SCENE — **Fall River, Massachusetts, February 2, 1928. A fire starting in the five-story mill building at the extreme left, lack of sprinkler protection, and a strong wind brought the devastation shown here. Loss: $2,514,000. Scenes like this have not been at all uncommon throughout America during the past quarter-century.**

have not been at all uncommon throughout America during the past quarter-century.

International.

WHERE THERE'S SMOKE — **Nashua, New Hampshire, May 4, 1930. From a seemingly insignificant blaze on a railroad bridge, this fire grew and raced through the manufacturing and residential district, destroying 350 buildings and bringing a loss of $2,000,000. Flying brands falling on wooden shingle roofs were the chief reason for the fire's spread over a mile-long area.**



THE MORNING AFTER — Norfolk, Virginia, June 7, 1931. Looking toward the waterfront, where a fire, starting in a frame wharf, destroyed or damaged sixty buildings with a loss of $1,250,000.

Acme.

FROM A BONFIRE UNDER THE BOARDWALK — **Coney Island, New York, July 13, 1932. A delayed alarm, combustible construction, lack of exposure protection, and an ocean breeze soon gave this fire conflagration proportions. The loss totaled $2,000,000. It was the third such disaster to strike this famous seaside resort.**

F. C. Scott.

SET BY A PYROMANIAC **— Ellsworth, Maine, May 7, 1933. The fire in this old wooden storehouse, long recognized as a fire menace, eventually destroyed 127 buildings with a loss of $1,300,000. It was set with criminal intent. Note the furious burning of the wooden roof, from which flying brands spread to other wooden shingle roofs, resulting in a conflagration.**

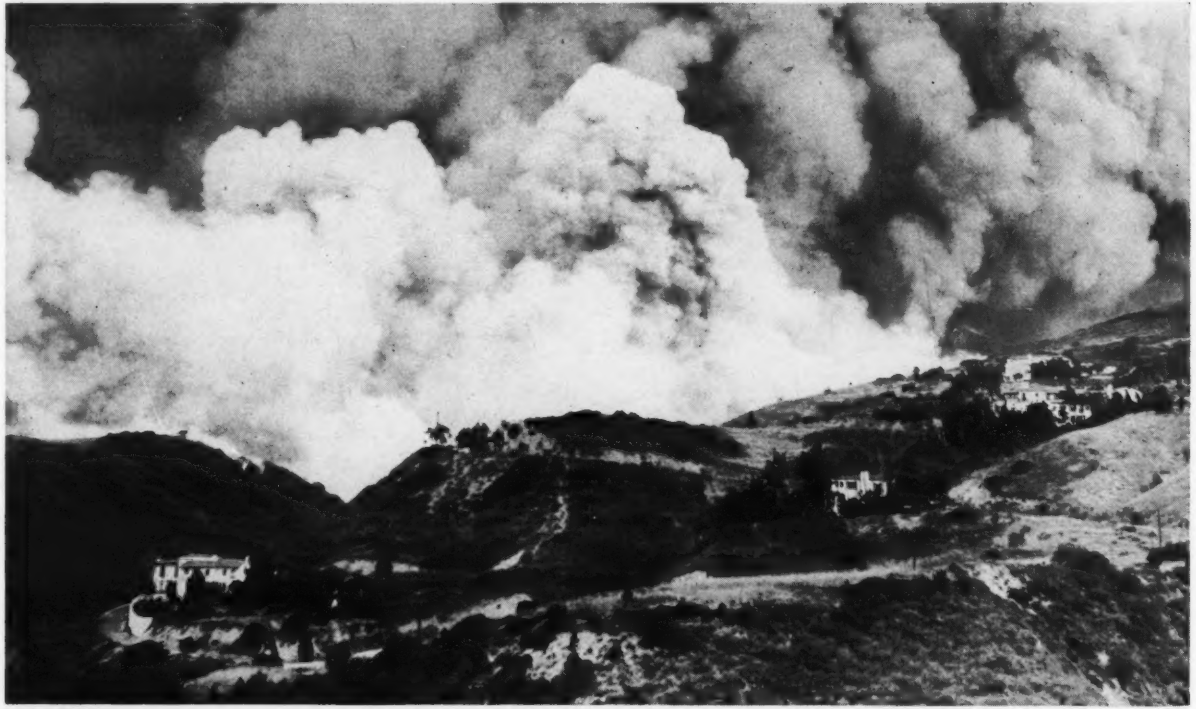
D. M. Maher.

A block of dwellings burning at the height of the conflagration, showing the character of construction and extreme rapidity of burning. Inadequate water supply and high wind handicapped firemen.

"AS MAINE GOES" **— Auburn, Maine, May 15, 1933. 250 buildings were destroyed and a loss of $1,500,000 sustained, largely because of wooden shingle roofs. This is but one of many such examples to be found in various parts of the United States in recent years.**

ONLY THE BEGINNING — Newburyport, Massachusetts, May 19, 1934. The start of a conflagration that eventually raged over an area half a mile long. Contributing factors: Frame construction, wooden shingle roofs, inoperative sprinklers, a high wind. Loss: $400,000. This picture was taken just fifteen minutes after the fire's start.

COWS AND A CONFLAGRATION: THE O'LEARY LEGEND RECALLED — Chicago, Illinois, May 19, 1934. Flames swept through the Chicago stockyards after heat and drought had thoroughly baked the wooden pens and runways. Congested arrangement of the yards made access to them difficult. The loss was $4,617,000, including damage to several adjacent blocks.



Wide World.

COMING ON! **—Southern California, November 23, 1938. Huge billows of smoke conceal the rapid advance of flames which raged for seven days in the forest and woodland region of Southern California. $3,000,000 worth of watershed values, hotels, and homes were destroyed over an extended area, as high winds, low humidity and inadequate water supplies spread the fires with devastating speed.**

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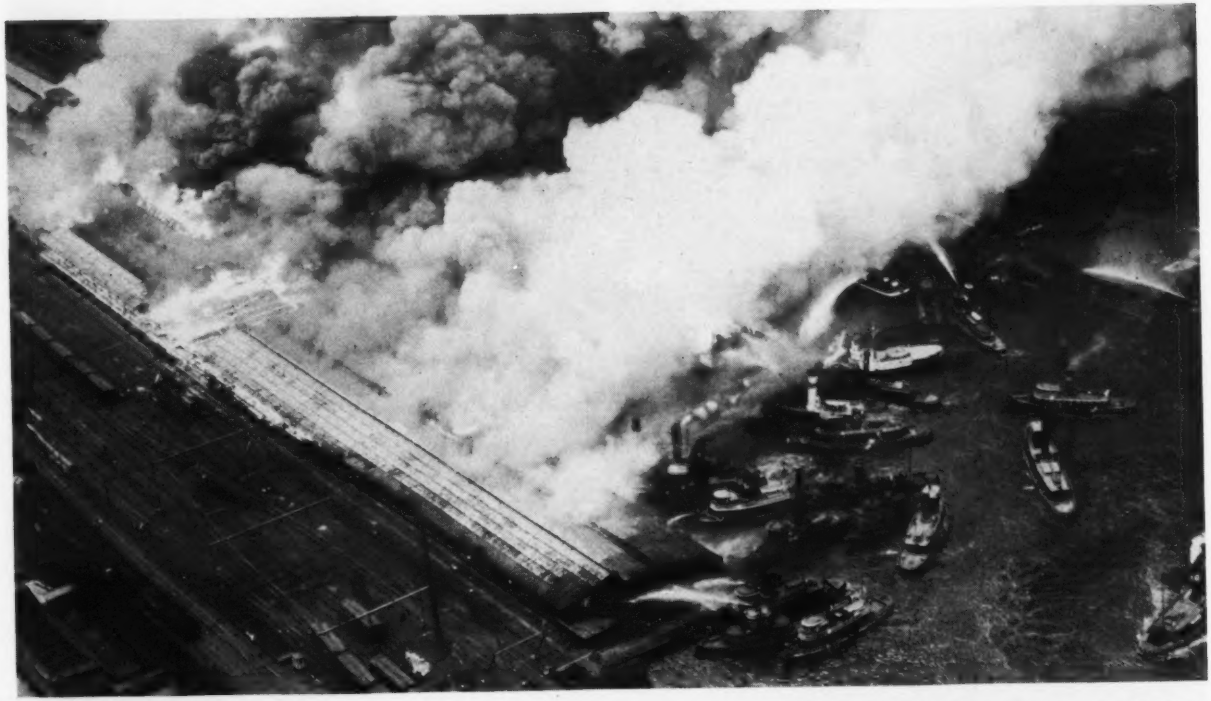
IN A SINGLE AFTERNOON — Marshfield, Massachusetts, April 21, 1941. Just a little more than four hours was required for this conflagration, which started very modestly in a small grass fire, to level 450 frame buildings and bring a loss of $1,100,000. Dry weather conditions, unsubstantial construction, wooden shingle roofs, and a high wind proved to be a disastrous combination of factors.



International.

FIRE ON THE WATERFRONT — **Jersey City, New Jersey, May 31, 1941. $5,000,000 worth of damage was done by this fire, which destroyed grain elevators, warehouses, piers, barges, and several hundred head of livestock. The existence of "conflagration breeders" and their frequent inaccessibility to fire-fighters are characteristic of many waterfront properties in the United States.**

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International.

BOSTON'S WORST IN THIRTY YEARS — Boston, Massachusetts, September 18, 1941. Four huge freight sheds, 15 box cars, and numerous miscellaneous structures were destroyed by this fire in the Charlestown railroad yards. The fallacy of storing large values of goods in buildings of inferior types, closely grouped and without the benefit of automatic sprinklers or automatic fire alarm, together with inadequate exposure protection for adjacent structures, was clearly illustrated here. Approximate loss: $1,400,000.

FOR THE DEFENSE? — Fall River, Massachusetts, October 11, 1941. Carelessness and a combination of tragic errors brought this $11,000,000 conflagration to a plant of vital importance in the nation's wartime production effort. Thousands of tons of crude rubber, 10% of the entire U. S. rubber reserve, and several mill buildings were consumed.

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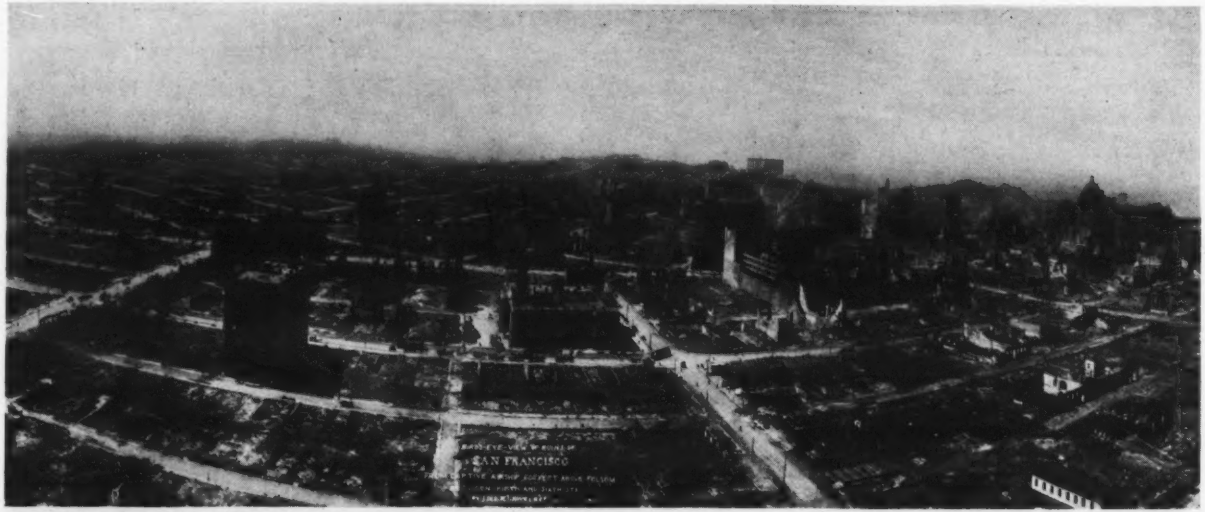
GONE WITH THE WIND — **Chicago, Illinois, October 8, 1871. One of the great tragedies of history. 250 lives, 17,430 buildings, and $168,000,000 were lost as a strong prairie wind swept the flames fiercely through a city that was built to burn.**

THE HUB PAID A HEAVY PRICE — **Boston, Massachusetts, November 9, 1872. The ruins of Boston after a terrible conflagration had leveled 776 buildings at a cost of $75,000,000 and 13 lives, a disaster that New England will never forget.**

(*Both pictures: Courtesy of the Insurance Library Association of Boston.*)

ORIOLES AND OYSTERS AND EIGHTY CITY BLOCKS — **Baltimore, Maryland, February 7, 1904. An unsprinklered building, combustible contents, unprotected window openings, non-standard hose couplings, and then—a conflagration! Eighty city blocks were destroyed at a cost of $50,000,000, and Baltimore had added to the list of things for which it had long been famous.**



Courtesy Kaler, Carney, Lifler and Company.

GREATEST IN HISTORY **— San Francisco, California, April 18, 1906. Shortly after five o'clock on the morning of the 18th, a series of earthquakes struck San Francisco, damaging many buildings and starting innumerable fires throughout the city. The force of the quakes was sufficient to break most of the municipal water mains and this proved a serious handicap to fire-fighting operations. The flames, aided by a strong wind of their own creation, swept on unchecked for two days. 500 lives were lost and more than 28,000 buildings destroyed at a cost of $350,000,000. This fire, the largest loss conflagration of all time, reminded the world that fire protection is** *everybody's* **business.**

T. E. Penard.

DESIGN FOR DESTRUCTION — **Chelsea, Massachusetts, April 12, 1908. Originating in the rag shop district, this fire spread rapidly over wooden shingle roofs. 3500 buildings were destroyed, with a loss of $12,000,000.**

Table I.

Conflagrations Since 1914 in the United States and Canada.

Date	Location	Property Destroyed	Reported Loss
June 25, 1914	Salem, Mass.	1600 buildings (6 killed)	$14,000,000
	(Wooden shingle roofs, high wind, inadequate public protection)		
Sept. 23, 1915	Hampton Beach, N. H.	40 buildings	200,000
	(Wooden shingle roofs, inadequate public protection)		
Nov. 29, 1915	Avalon, Calif.	Several hotels and business blocks	1,000,000
	(Inadequate public protection)		
Feb. 15, 1916	Fall River, Mass.	25 business buildings	900,000
	(Lack of exposure protection)		
March 21, 1916	Paris, Texas	1440 buildings	11,000,000
	(Wooden shingle roofs, high wind, lack of exposure protection)		
March 22, 1916	Nashville, Tenn.	648 buildings (1 killed)	1,500,000
	(Wooden shingle roofs, high wind)		
March 22, 1916	Augusta, Ga.	682 buildings	4,250,000
	(Wooden shingle roofs, inadequate public protection)		
May 21, 1917	Atlanta, Ga.	1938 buildings	5,500,000
	(Wooden shingle roofs, fire department at other fires)		
April 4, 1918	Kansas City, Mo.	21 industrial buildings	2,000,000
	(Inadequate water distribution system, lack of exposure protection)		
April 8, 1918	West Tampa, Fla.	9 city blocks	200,000
	(Wooden shingle roofs)		
June 25, 1918	Cle Elum, Wash.	17 blocks	550,000
	(Wooden shingle roofs, high wind)		
Aug. 13, 1918	Marianna, Ark.	15 business buildings	750,000
	(Inadequate water distribution system)		
Oct. 12, 1918	Minnesota	Forest fires covering 15 townships; 559 killed	25,000,000
	(Wooden shingle roofs, high wind, dry weather conditions)		
Feb. 14, 1919	Savannah, Ga.	11 factory and warehouse buildings	1,000,000
	(Inadequate public protection, congestion of occupancies)		
May 21, 1919	Mobile, Ala.	192 buildings	200,000
	(Wooden shingle roofs, non-standard hose and hydrant couplings)		
Aug. 27, 1919	Los Banos, Calif.	48 buildings	500,000
	(Inadequate water distribution system)		
March 14, 1920	Grandview, Texas	136 buildings	2,000,000
	(Wooden shingle roofs, inadequate water distribution, high wind)		
Jan. 25, 1921	Athens, Ga.	14 buildings	800,000
	(Inadequate water distribution, inadequate public protection)		
June 26, 1921	Hampton Beach, N. H.	50 buildings	500,000
	(Wooden shingle roofs, high wind, inadequate public protection)		
Aug. 2, 1921	Richibucto, N. B.	40 buildings	320,000
	(No data)		
Dec. 4, 1921	Yuma, Ariz.	25 business buildings (1 killed)	1,000,000
	(No data)		
March 15, 1922	Chicago, Ill.	13 business buildings	5,500,000
	(Lack of exposure protection, delay in discovery of fire)		
April 13, 1922	Norfolk (Berkley), Va.	100 buildings, 3 boats and lumber mill	750,000
	(Wooden shingle roofs, inadequate water distribution system)		
June 15, 1922	New York, N. Y.	141 buildings (Arverne section)	2,000,000
	(Wooden shingle roofs, inadequate water distribution system)		
Oct. 4, 1922	Northern Ontario	Forest conflagration covering 18 townships (44 killed)	6,369,000
	(Wooden shingle roofs, high wind, dry weather conditions)		

Date	Location	Property Destroyed	Reported Loss
Dec. 1, 1922	New Bern, N. C.	1000 buildings	1,500,000
	(Wooden shingle roofs, high wind)		
Dec. 1, 1922	Terrebonne, P. Q.	75 buildings	500,000
	(Inadequate water distribution system, high wind)		
Dec. 8, 1922	Astoria, Ore.	30 city blocks in the business section	10,000,000
	(Inadequate public protection, fire spread to inaccessible areas)		
March 28, 1923	Hull, Mass.	44 buildings	250,000
	(Wooden shingle roofs, high wind, severe winter conditions)		
May 26, 1923	St. Agathe, P. Q.	150 buildings	400,000
	(No data)		
June 2, 1923	Canaan, N. H.	44 buildings (2 killed)	150,000
	(Wooden shingle roofs)		
July 13, 1923	Mace and Burke, Idaho	2 mining towns in Burke Canyon	750,000
	(Wooden shingle roofs, inadequate public protection)		
Sept. 17, 1923	Berkeley, Calif.	640 buildings	6,000,000
	(Wooden shingle roofs, high wind, brush fire entered city)		
Nov. 14, 1924	Jersey City, N. J.	2 blocks of factories and tenements	1,000,000
	(High wind, lack of exposure protection, congestion of occupancies)		
June 11, 1925	Nahant, Mass.	50 buildings	300,000
	(Wooden shingle roofs, inadequate water distribution system)		
Sept. 4, 1925	Shreveport, La.	196 buildings	1,000,000
	(Wooden shingle roofs, failure of water pumps)		
March 1, 1926	Newport, Ark.	280 buildings (1 killed)	1,500,000
	(Wooden shingle roofs, inadequate public protection)		
June 4, 1927	Montgomery, Ala.	22 buildings	1,500,000
	(Lack of exposure protection, ineffective fire fighting)		
Oct. 11, 1927	Ocean City, N. J.	30 buildings	810,926
	(Wooden shingle roofs, high wind)		
Feb. 2, 1928	Fall River, Mass.	38 buildings destroyed, 69 damaged (1 killed)	2,514,000
March 29, 1928	Crisfield, Md.	90 buildings	700,000
	(Delay in discovery of fire, failure of water pumps)		
April 20, 1928	Richwood, W. Va.	45 buildings	400,000
	(Inadequate public protection)		
July 2, 1929	Mill Valley, Calif.	130 buildings	1,500,000
	(Wooden shingle roofs, inadequate water distribution)		
July 21, 1929	Wainwright, Alta.	67 buildings	1,000,000
	(No data)		
May 4, 1930	Nashua, N. H.	350 buildings	2,000,000
	(Wooden shingle roofs, inadequate water distribution system)		
June 7, 1931	Norfolk, Va.	60 buildings	1,250,000
	(Lack of exposure protection, congestion of occupancies)		
June 22, 1931	St. John, N. B.	Waterfront conflagration	5,000,000
	(Ineffective fire fighting, fire spread to inaccessible areas)		
June 27, 1931	Spencer, Iowa	24 business buildings	800,000
	(Inadequate water distribution system, lack of exposure protection)		
March 1, 1932	Pennsgrove, N. J.	36 buildings destroyed, 23 damaged	400,000
	(Wooden shingle roofs, inadequate water distribution system)		
July 13, 1932	New York, N. Y.	5 city blocks (Coney Island section)	2,000,000
	(Delay in giving alarm, fire spread to inaccessible areas)		
Sept. 8, 1932	Highland Boy, Utah	63 buildings	350,000
	(Inadequate public protection, congestion of occupancies)		
May 7, 1933	Ellsworth, Me.	127 buildings	1,300,000
	(Wooden shingle roofs, inadequate water distribution system)		
May 15, 1933	Auburn, Me.	250 buildings	1,500,000
	(Wooden shingle roofs, high wind)		

Date	Location	Property Destroyed	Reported Loss
June 25, 1933	Lowell, Mass.	10 buildings destroyed, 35 damaged...	250,000
	(Wooden shingle roofs, congestion of occupancies)		
Aug. 7, 1933	Cornwall, Ont.	31 business buildings.....	241,670
	(Wooden shingle roofs, high wind, congestion of occupancies)		
Jan. 28, 1934	Wrightsville Beach, N.C.	103 buildings.....	550,000
	(Wooden shingle roofs, inadequate public protection)		
May 19, 1934	Newburyport, Mass.	29 buildings destroyed, 9 damaged....	400,000
	(Wooden shingle roofs, lack of exposure protection)		
May 19, 1934	Chicago, Ill.	Stockyard area and business buildings (1 killed).....	4,617,000
Sept. 17, 1934	Nome, Alaska	20 city blocks.....	2,000,000
	(Inadequate water distribution system, inadequate public protection)		
July 28, 1934	Dorris, Calif.	Factory, 61 buildings.....	276,416
	(Wooden shingle roofs)		
Oct. 23, 1935	Los Angeles Co., Calif.	Forest fires, 222 buildings.....	3,617,835
	(Inadequate water distribution system, forest fires entered town)		
July 4, 1936	Remsen, Iowa	34 buildings.....	250,000
	(Wooden shingle roofs, inadequate water distribution system)		
Sept. 26, 1936	Bandon, Ore.	386 buildings (13 killed).....	1,300,000
	(Wooden shingle roofs, high wind, forest fire entered town)		
June 2, 1936	Portland, Me.	18 buildings destroyed, 17 damaged (Peaks Island).....	75,000
	(Wooden shingle roofs, inadequate water distribution system)		
Jan. 24, 1937	Cincinnati, Ohio	Oil tanks, factories, dwellings.....	1,225,000
	(Aftermath of flood)		
Aug. 24, 1938	Hardin, Missouri	16 business buildings.....	150,000
	(Inadequate water distribution system, ineffective fire fighting)		
Sept. 21, 1938	New London, Conn.	50 buildings destroyed or damaged....	1,000,000
	(Hurricane, delay in giving alarm)		
Nov. 23, 1938	Southern California	Forest fires, many buildings.....	3,000,000
	(Inadequate water distribution system, high wind, dry weather)		
March 21, 1939	Sandusky, Ohio	Block in business district.....	750,000
	(Lack of exposure protection)		
May 11, 1939	Chicago, Ill.	5 grain elevators (9 killed).....	3,500,000
	(Lack of exposure protection, private fire protection failed)		
Aug. 19, 1939	Pine Ridge, Ore.	Buildings, forest.....	2,000,000
	(Dry weather, private fire protection failed)		
Jan. 20, 1940	Columbus, Miss.	2 city blocks.....	300,000
	(Lack of exposure protection, inadequate public and private protection)		
July 30, 1940	Camden, N. J.	Factory, 32 dwellings destroyed, 31 damaged (10 killed).....	2,000,000
	(Lack of exposure protection, private fire protection failed)		
April 21, 1941	Marshfield, Mass.	450 buildings	1,100,000
	(Wooden shingle roofs, high wind, brush fire entered town)		
May 31, 1941	Jersey City, N. J.	Waterfront conflagration.....	5,000,000
	(Lack of exposure protection, delay in giving alarm)		
Sept. 18, 1941	Boston, Mass.	4 railway freight sheds.....	1,575,466
	(Lack of exposure protection, private fire protection failed)		
Oct. 11, 1941	Fall River, Mass.	5 factory buildings, adjacent properties	11,000,000
	(Watchman shut off sprinklers, no adequate barrier to the spread of fire through congested buildings)		
Nov. 24, 1941	Seward, Alaska	13 business buildings.....	500,000
	(Frame construction, inadequate public and private protection)		
Feb. 8, 1942	Philadelphia, Pa.	20 dwellings and business structures...	1,000,000
	(Inadequate private protection, high wind, freezing temperature)		

Table II.

Conflagrations in the United States Occurring Prior to 1914 Involving Losses in Excess of $3,000,000.

Date	Location	Property Destroyed	Loss
1835	New York, N. Y.	Buildings covering thirteen acres	$15,000,000
1845	Pittsburgh, Pa.	1000 buildings	3,500,000
1849	St. Louis, Mo.	425 buildings, 27 steamships (1 killed)	3,500,000
1851	San Francisco, Cal.	2500 buildings	3,500,000
1861	Charleston, S. C.		10,000,000
1866	Portland, Me.	1500 buildings	10,000,000
1871	Chicago, Ill.	17,430 buildings	168,000,000
1872	Boston, Mass.	776 buildings (13 killed)	75,000,000
1874	Chicago, Ill.		5,000,000
1889	Seattle, Wash.		5,000,000
1889	Spokane, Wash.		6,000,000
1889	Boston, Mass	52 buildings (4 killed)	3,600,000
1889	Lynn, Mass.		5,000,000
1892	Milwaukee, Wis.		6,000,000
1900	Hoboken, N. J.	Piers and steamships (326 killed)	4,600,000
1901	Jacksonville, Fla.	1700 buildings	11,000,000
1902	Paterson, N. J.	525 buildings	5,500,000
1904	Baltimore, Md.	80 city blocks in business section	50,000,000
1906	San Francisco, Cal.	28,000 buildings	350,000,000
1908	Chelsea, Mass.	3500 buildings (1 killed)	12,000,000
1911	Bangor, Me.	267 buildings (2 killed)	3,188,081

Table III.

Typical Fires Since 1914 with Losses Reported at $3,000,000 or More. Not Classified as Conflagrations.

Date	Location	Description	Estimated Loss
1916	Jersey City, N. J.	Black Tom Disaster, R. R. terminal	$22,000,000
1917	Kingsland, N. J.	Munitions plant	12,000,000
1918	St. Louis, Mo.	Government warehouse	3,000,000
1918	Morgan Station, N. J.	Munitions plant	5,000,000
1919	Cedar Rapids, Iowa.	Starch factory	3,000,000
1921	Warner, N. J.	Oil refinery	3,000,000
1922	New Orleans, La.	Wharves, U. S. Army Supply Base	4,500,000
1925	Beaumont, Texas.	Ships	3,500,000
1925	New Orleans, La.	Wharves and warehouses	4,000,000
1926	San Luis Obispo, Calif.	Oil reservoirs	8,265,000
1926	Brea, Calif.	Oil reservoirs	3,600,000
1926	Lake Denmark, N. J.	Arsenal explosion	75,000,000
1929	Hollywood, Calif.	Film laboratory	3,145,000
1931	Buffalo, N. Y.	Armory	5,032,000
1933	Tillamook Co., Ore.	Forest fire	10,000,000
1937	Lakehurst, N. J.	Zeppelin *Hindenburg*	3,750,000
1942	New York, N. Y.	U.S.S. *Lafayette* (*Normandie*)	60,000,000(?)

Factors Responsible for Conflagrations.

The factors listed below are derived from a study of reports of the seventy-nine conflagrations listed in Table I. Conflagrations are seldom due solely to any one factor and the summary below indicates the number of fires to which each factor has contributed rather than one outstanding factor for each fire. No attempt has been made to list all the minor factors responsible for the spread of these fires, but the principal ones have been determined as accurately as possible from the reports in the N.F.P.A. fire record files.

Inferior and combustible construction is a serious factor in the development of conflagrations and is a particularly vital matter where large areas of closely built frame structures exist in congested sections. Combustible construction and contents of buildings have obviously contributed to every conflagration and, for this reason, have not been specifically listed except where the factors of congestion and inaccessibility have been involved.

Table IV.

Principal Factors Contributing to Conflagrations in the United States and Canada Since 1914.

(Not including combustible construction or contents which contribute to every fire)

	Factor	Number of Times Contributing
1	Wooden shingle roofs	38
2	Inadequate water distribution system	30
3	Wind velocity in excess of 30 m.p.h. or "high"	27
4	Lack of exposure protection	20
5	Inadequate public protection	17
6	Unusually hot or dry weather conditions	11
7	Congestion of hazardous occupancies difficult of access for fire fighting	10
8	Delay in discovery of fire	8
9	Forest or brush fire entered town	8
10	Private fire protection failed or inadequate	7
11	Delay in giving alarm	5
12	Ineffective fire fighting	4
13	Failure of water pumps or breakage of pipes	4
14	Fire department at other fires	4
15	Fire spread through inaccessible open spaces under piers or buildings	4
16	Winter conditions severe	3
17	Earthquake, floods, hurricane, etc.	2
18	Hose couplings or hydrant connections not standard	2
19	Cotton, rags, etc., stored outside of buildings	1

Fires in Which There Was Loss of Life.

First Quarter, 1942.

One hundred and thirty-four fatal fires have been reported to the Department of Fire Record during the past three months.* These fires were responsible for the loss of three hundred and fifty-four lives, an average of nearly three fatalities per fire. Eighteen fires resulting in the loss of five or more lives each, are summarized below.

DECEMBER 16, 1941, ROTTERDAM, N. Y. Eight patients were burned to death in a fire which destroyed the Riverview Convalescent Home. (See January, 1942, QUARTERLY, p. 282.) (H-44410.)

DECEMBER 21, 1941, BURLINGTON TWP., N. J. An entire family was wiped out by a fire which destroyed their rural home during the early morning. All the victims, including two women and two children, are believed to have been suffocated in bed before being burned. The fire has been attributed to a faulty or overheated kerosene stove that was left burning all night. (L-06640.)

DECEMBER 25, 1941, HILLSIDE, MD. A man, his daughter and three grandchildren were burned to death, while eight other persons escaped, as flames gutted a small apartment building. Origin of the fire, which started early in the morning, was not determined. (L-06642.)

DECEMBER 25, 1941, ST. LOUIS, MO. Ten persons died and twenty-two others were injured when a passenger bus crashed into a 200-gallon fuel oil tank in a yard, after colliding with an automobile. The oil storage tank burst, enveloping the bus in flames. Passengers stampeded for the exits, but many were trapped when the rear door became jammed shut. (H-44411.)

JANUARY 7, 1942, WASHINGTON, D. C. Two women and four children were fatally burned in a fire which gutted their two-story brick home. The fire started when an overheated oil stove "exploded." Six others, including a fireman, suffered injuries. (L-06646.)

JANUARY 10, 1942, NEAR SILVERTON, COLORADO. Eight miners were suffocated as they retreated through long tunnels in a futile effort to escape smoke and fumes pouring into a silver mine from a fire at the entrance of the shaft. The fire started in the machine shop of the mine property when oil became ignited in an unknown manner, and soon spread to other frame structures at the head of the mine. (H-44412.)

JANUARY 11, 1942, SHIPSHAW, P. Q. At least fifteen men were burned to death and twenty-eight others injured when fire of uncertain origin swept through a large frame construction camp bunkhouse. The fire broke out shortly after midnight, only a few minutes after the watchman had made his rounds, and spread so rapidly that many of the ninety occupants died before they could reach doors or jump through windows. Firemen, who prevented the spread of the flames to other structures, were hampered when a 12-inch water main broke during the fire. (H-44409.)

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*This record is made up from those reports received between December 16, 1941, and March 19, 1942. A few of the fires included herein occurred prior to December 16, but were not reported until subsequent to that date.

JANUARY 20, 1942, LYNN, MASS. Thirteen persons, including nine women, died in an early morning fire which destroyed a five-story apartment house. A report of this fire will be found on page 333. (H-44413.)

JANUARY 29, 1942, MOUNT HARRIS, COLO. What is believed to have been an explosion of mine gas killed thirty-four workmen in a coal mine. The victims were trapped more than a mile below the surface, while four other miners, who were working near an air shaft 3000 feet down, managed to make their escape. This is reported to have been the worst coal mine disaster in Colorado in twenty-five years. (H-44414.)

FEBRUARY 4, 1942, NEAR EMLENTON, PA. Seven persons, including a woman and five children, were burned to death in a fire which destroyed their small frame home. One child managed to escape through a window. The cause of the fire, which occurred during the early morning, was not determined. (L-06643.)

FEBRUARY 4, 1942, SAN DIEGO, CAL. Six prisoners perished and twelve others were burned in a fire which swept through the cell block of the municipal jail. The fire started when a prisoner, charged with drunkenness, deliberately set fire to the cork and roofing felt padding of the cell walls. All the victims were confined on the tier of cells above the one where the fire started. (H-44415.)

FEBRUARY 7, 1942, CHATTANOOGA, TENN. Five persons, two of them women, were trapped by fire which destroyed the Southern Hotel. The fire is believed to have started on the second floor in a room used for the storage of trunks and baggage and spread rapidly through the three-story brick-joist building. Eight persons were rescued by firemen despite smoke-filled corridors. (H-44416.)

FEBRUARY 8, 1942, MARKHAM, ONT. Five children were burned to death when fire, believed to have started from an overheated furnace, swept through their two-story frame home. One child was saved by the parents as they escaped from the burning building. (L-06644.)

FEBRUARY 23, 1942, AKRON, OHIO. Fire which started on the second floor of the Elanor Hotel spread up the stairway to the third floor and roof, asphyxiating three men and two women and causing the death of a third woman who jumped to the ground. The hotel was a 70-year-old structure with brick walls and combustible interior. (H-44417.)

MARCH 1, 1942, VILLE EMARD, P. Q. A defective furnace smoke pipe caused a fire and explosion which destroyed an apartment building with the loss of seven lives. Three of the victims were firemen, trapped in the basement when an explosion of smoke and hot gases occurred. The lower floor was occupied as a furniture store, while the upper floors were apartments. The fire was first discovered on the third floor, and was believed by firemen to be under control when the explosion took place, spreading the fire throughout the brick-joist structure. (H-44418.)

MARCH 2, 1942, GLADWIN, MICH. Six members of a family were burned to death in a fire which destroyed their unfinished frame home. An overheated stove or defective chimney is reported to have caused the fire. (L-06645.)

MARCH 4, 1942, BURLINGTON, IOWA. Twenty-two men were killed and fifty others injured by an explosion at the Iowa Ordnance Plant. The explosion occurred from an unknown cause in a building where explosives were melted prior to use in the loading of shells. (H-44420.)

MARCH 6, 1942, NEAR STUART, FLA. A twin-engined Army transport plane exploded in mid-air and fell in flames into a river, bringing death to seven persons. Cause of the explosion was not determined. (L-06660.)

Typical Fatal Fires.

Children Alone in House.

DECEMBER 9, 1941, WILLIAMSTOWN, KAN. While their mother walked a half-mile to get the mail, three small children were burned to death when fire destroyed their rural home. The father was at work when the tragedy occurred. The four-room dwelling was completely burned in about twenty minutes. The cause of the fire could not be determined. (L-06647.)

DECEMBER 16, 1941, YARMOUTH, N. S. A four-year-old boy, who played with matches while his mother was out of the house, was responsible for a fire which killed his infant brother. The smaller child was asphyxiated by smoke from a small fire which was set in the bedroom. (L-06648.)

JANUARY 12, 1942, MONTREAL, P. Q. Fire which started while a mother was trying to find out whether her husband had escaped the disastrous fire at Shipshaw, P. Q. (see page 396), resulted in the death of her four-year-old daughter. When the mother left the house to go to the telegraph office, she asked a neighbor to take care of her two children. Although the neighbor left her home immediately, by the time she reached the house, the older child had already set fire to a divan and her clothing while playing with matches. The child died in a hospital a few hours later. (L-06649.)

Clothing Ignited.

DECEMBER 31, 1941, PAWTUCKET, R. I. An elderly blind woman was fatally burned when her nightgown became ignited as she attempted to burn some waste paper in a small parlor stove. (L-06650.)

MARCH 6, 1942, NEW YORK, N. Y. An elderly woman was fatally burned when her bathrobe caught fire while she was warming her feet in the oven of a gas stove. (L-06651.)

MARCH 14, 1942, WASHINGTON, D. C. A nine-year-old girl died in a hospital from burns suffered when her dress caught fire as she stood in front of a gas heater. (L-06652.)

Escaping Fires.

DECEMBER 8, 1941, WILMINGTON, N. C. A man was drowned when he jumped from a barge moored alongside an oil tanker which had caught fire. Firemen extinguished the blaze after the ship's superstructure had been destroyed. The oil cargo which had been partly discharged did not become ignited. (H-44421.)

FEBRUARY 20, 1942, WASHINGTON, D. C. A woman was killed when she jumped from a window as fire swept her third-floor apartment. The fire originated from an unknown cause on the third floor of a rooming house, and swept down through a dumb-waiter shaft. A fireman and two residents received minor injuries. (L-06653.)

FEBRUARY 27, 1942, MARTINEZ, CAL. Five men jumped overboard from a burning oil tanker, but only three reached safety. Others among the crew of the tanker remained on board and fought the fire successfully. (H-44422.)

Explosives.

DECEMBER 23, 1941, KENVIL, N. J. One man was killed and four others received minor injuries when an explosion demolished a two-story building at

the Hercules Powder Company plant, where a similar blast took forty-nine lives in September, 1940. (See October, 1940, QUARTERLY, page 174.) (H-44423.)

JANUARY 13, 1942, BELLEVUE, D. C. Two men and a woman were killed and eight other persons injured when an explosion shattered a small fuse loading house at the U. S. Naval Research Laboratory and Magazine. (H-44424.)

JANUARY 31, 1942, COOKSVILLE, ONT. A young man died in a hospital from burns and lacerations suffered when an explosion occurred in the powder-mixing plant of T. W. Hand & Co. The plant is engaged in manufacturing military pyrotechnics. (H-44425.)

FEBRUARY 19, 1942, KINGSBURY, IND. Two men were killed and four others injured in an explosion which occurred in the shell loading department of the huge Kingsbury Ordnance Plant. (H-44426.)

Fire Fighting.

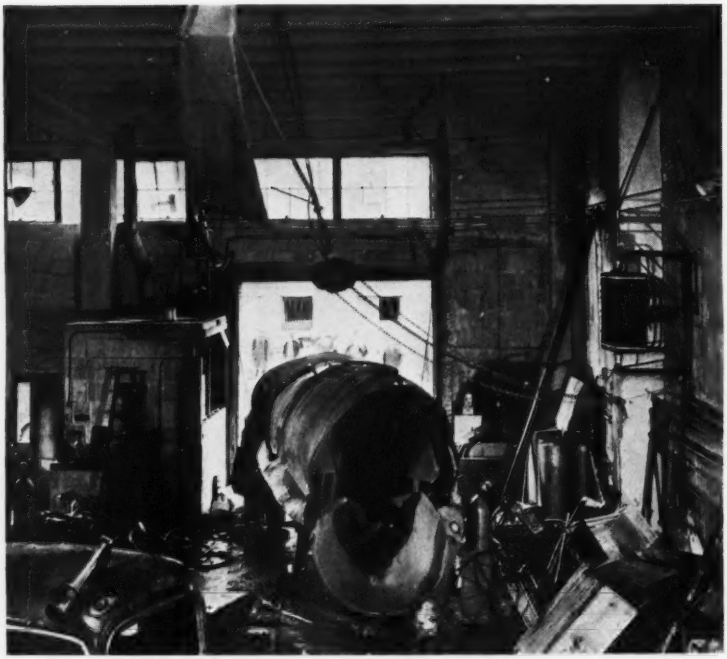
JANUARY 9, 1942, ST. PAUL, MINN. Three firemen were asphyxiated by smoke while attempting to shut a fire door separating an athletic club from a store building, which was on fire. Their bodies were recovered by members of the rescue squad who entered the building with gas masks, but efforts to revive the victims were without avail. (H-44427.)

JANUARY 30, 1942, SAN FRANCISCO, CAL. A fire department officer lost his life while fighting a fire which destroyed an automobile warehouse and salesroom. He was partially overcome by smoke, but managed to make his way to the sidewalk before he collapsed. He was dead on arrival at a hospital. (H-44428.)

Loss of Life by Fire, January-March, 1942.

This is a typical rather than a complete record, presented to show the conditions under which loss of life occurs, that they may be known and guarded against. The total loss of life by fire in the United States is estimated at 10,000 annually.

Occupancy	No. Fires	Men	Women	Children	Total
Aircraft	3	13	0	0	13
Apartments, Hotels, Lodgings, Tenements, etc.	30	23	28	19	70
Boats and Ships (except Tank Vessels)	1	1	0	0	1
Tank Vessels	3	5	0	0	5
Churches and Church Property	1	1	0	0	1
Dwellings—rural	21	9	10	41	60
Dwellings—urban	35	15	13	20	48
Forest and Brush Fires	2	2	0	0	2
Garages and Filling Stations	3	3	0	1	4
Hospitals and Institutions	2	2	7	0	9
Manufacturing Occupancies	4	2	5	0	7
Mercantile Occupancies	3	8	3	0	11
Mining Property	2	42	0	0	42
Motor Vehicles (except Tank Trucks)	1	6	4	0	10
Tank Trucks	1	1	0	0	1
Munitions plants	5	28	1	0	29
Out-of-Door Fires	3	1	0	2	3
Prisons	1	6	0	0	6
Response to Alarms	5	5	0	0	5
Schools and Colleges	2	4	0	0	4
Other Known Buildings	6	22	0	1	23
Total	134	199	71	84	354



A man was killed in this shop when he attempted to use a welding torch on the gasoline trailer tank in a Washington, D. C., garage on January 18, 1942.

FEBRUARY 26, 1942, KANSAS CITY, MO. A fireman died more than two weeks after he was injured by the falling wall of a burning building which showered him with débris. (L-06654.)

Flammable Liquids and Vapors.

JANUARY 10, 1942, ALBUQUERQUE, N. M. An infant was fatally burned when his mother lighted a kerosene stove which had been filled with gasoline by mistake. The mother was also burned by the explosion which resulted, but not seriously. (L-06655.)

JANUARY 18, 1942, WASHINGTON, D. C. A man was killed by an explosion which took place when he attempted to do some welding on an "empty" gasoline trailer tank. The victim was on top of the tank and had just opened the hatch when the explosion occurred, blowing him violently against the ceiling. The blast ruptured the tank, and did considerable damage to the building. The force of the explosion was felt over a wide area. (H-44429.)

FEBRUARY 28, 1942, JAMESTOWN, N. Y. The danger of filling underground gasoline tanks through connections inside buildings was illustrated by an explosion which occurred in a garage, causing the death of two men and injuries to several others. A report of this fire will be found on page 344. (H-44430.)

Trapped in Burning Buildings.

DECEMBER 13, 1941, FREDERICKSBURG, VA. Two aged negroes, one an invalid and the other seriously ill, were burned to death when fire of unknown origin destroyed their two-story frame home. Two other women were injured, one when she jumped from a second story window. (L-06656.)

JANUARY 1, 1942, PHILADELPHIA, PA. A twelve-year-old boy was burned to death at a second-story window of his burning home because he was afraid to jump into a blanket held by four men. The boy, his parents and an infant brother had been trapped by the fire while they slept. The mother and father jumped to safety with the baby, although all were injured seriously. (L-06657.)

JANUARY 16, 1942, NORTH BRUNSWICK, N. J. Three little girls were trapped in their second-floor bedroom and burned to death when fire destroyed their home. The fire was believed to have been due to a defective or overheated flue. (L-06658.)

Causes of Loss of Life, January-March, 1942.

Fatalities classified according to the immediate cause of the loss of life rather than according to the cause of the fire.

Cause of Fatality	Men	Women	Children	Total
Aircraft Fires	13	0	0	13
Asphyxiation (Smoke and Gas Suffocation)	13	7	6	26
Children Alone in House	0	0	10	10
Children Playing with Matches	0	0	2	2
Clothing Ignited:				
1. Bonfires, Burning Rubbish, etc.	0	0	2	2
2. Furnaces, Stoves, and Heaters	0	4	1	5
3. Smoking and Matches	1	0	0	1
4. Smoking in Bed	0	1	0	1
5. Miscellaneous	1	1	0	2
Entering a Burning Building	2	1	0	3
Escaping fire; jumped, fell or drowned	3	6	1	10
Explosions:				
1. "Empty" Tanks, Welding of	1	0	0	1
2. Explosives	28	1	0	29
3. Miscellaneous and Unknown	1	0	0	1
Fire Fighting—Firemen	13	0	0	13
Flammable Liquids and Vapors:				
1. Gasoline and Similar Liquids:				
(*a*) Stoves, Lamps, and Torches	1	1	1	3
(*b*) Used to Kindle Fire	0	0	1	1
(*c*) Miscellaneous	1	0	0	1
2. Kerosene, Range Oil, and Fuel Oil:				
(*a*) Stoves, Lamps, and Torches	1	4	10	15
(*b*) Used to Kindle Fire	1	1	1	3
Forest and Brush Fires (including fire fighting)	2	0	0	2
Indirect Causes (overexertion, exposure, etc.)	2	0	0	2
Marine Fires	3	0	0	3
Mine Fires and Explosions	42	0	0	42
Motor Vehicle Fires (except Tank Trucks)	6	4	0	10
Tank Trucks	1	0	0	1
Response to Alarms	5	0	0	5
Trapped in Burning Buildings	57	40	49	146
Miscellaneous Known Causes	1	0	0	1
Total	199	71	84	354

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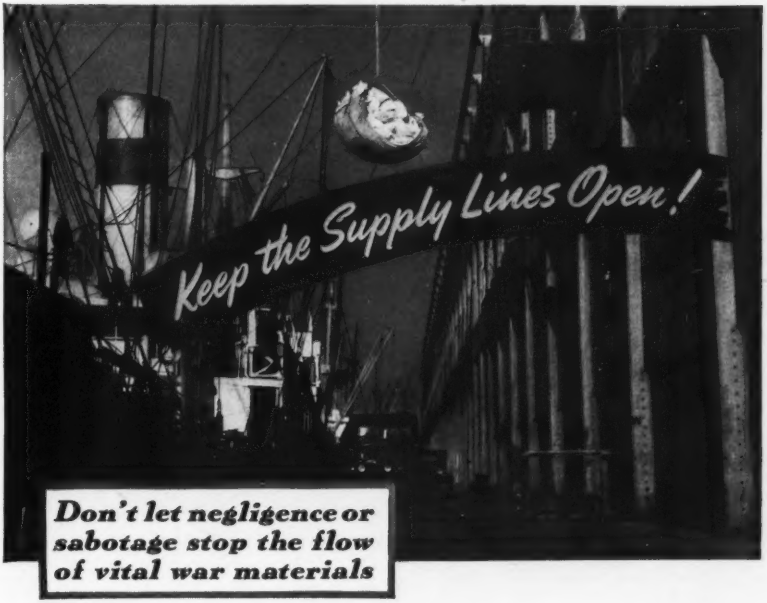


With this nation's industrial activities coordinated into one vast war production program, stoppages anywhere along the line may result in serious bottle-necks with consequent delays in delivery of supplies to our armed forces. With the threat of sabotage added to all the hazards of normal times, it is essential that all-out protection measures be provided to safeguard against interruption of production or destruction of vital materials by fire or other controllable hazards.

A.D.T. Protection eliminates the twin hazards—belated discovery and delayed alarms—which so often are responsible for disastrous losses through fire, sabotage and other causes. Adoption of one or more of the services listed below may not only prove the answer to your wartime protection problems, but may result in substantial savings as well.

For descriptive booklets and further information, write to your nearest A.D.T. office, or to our Executive Office, 155 Sixth Avenue, New York.

★ ★ ★

A.D.T. Electric Protection Services include the following: Sprinkler Supervisory and Waterflow Alarm • Aero Automatic Fire Alarm • Watchman Supervisory Service Manual Fire Alarms • Burglar Alarms Holdup Alarms • Invisible Ray Alarms for Sabotage Protection.

A. D. T. ELECTRIC PROTECTION SERVICES

Controlled Companies of **AMERICAN DISTRICT TELEGRAPH CO.** *155 Sixth Ave., New York*

CENTRAL STATION OFFICES IN ALL PRINCIPAL CITIES OF THE U.S.

A·D·T

Electric Protection Services

AGAINST FIRE · BURGLARY · HOLDUP

A NATION-WIDE ORGANIZATION

You Get DOUBLE DEFENSE with PYRANOL TRANSFORMERS

1. Defense against fire loss

Pyranol* transformers help protect industrial materials and equipment —now difficult to replace—because Pyranol, the cooling liquid in these transformers, CANNOT BURN. That's one reason why Pyranol transformers are being used extensively for industrial plant-expansion and new-building projects.

In ten years' experience, no Pyranol transformer has burned or contributed to a fire. Even if heat from surrounding blazes ruptures the tank, the fire hazard will not be increased—a safety feature which protects fire fighters.

2. Defense against material waste

Because Pyranol is noninflammable, the National Electrical Code permits Pyranol transformers to be installed without fireproof enclosures, either indoors or outdoors—saving vital construction materials and floor space. Install them in the basement, on a beam, or in any unused area near the load center.

Pyranol provides the safe, low-cost way to put transformers right where needed. Call our local office for details, or write for Bulletin GEA-2637. *General Electric, Schenectady, N. Y.*

*Reg. U.S. Pat. Off.

GENERAL ELECTRIC

Your copy of this Deluge System bulletin will be sent on request.

VIKING HANGAR DELUGE SYSTEM

. . . Automatically deluges water from combination of open overhead and open floor sprinklers when room temperature rises suddenly or room temperature rises to a predetermined fixed temperature.

The TYDEN self-setting control valve employed in the VIKING Deluge System is the **only** automatic deluge valve that resets itself after operation . . . To put the system in operative condition following flooding it is only necessary to shut off main water supply, drain water from the system and raise small handle of the relief valve. Then close drain valves, again open water supply valve and the system is ready for operation . . . Write VIKING CORP. for full details regarding installation and maintenance of Viking Hangar Deluge System.

Representatives in Principal Cities

THE VIKING CORPORATION

HASTINGS, MICHIGAN, U. S. A.

PROTECTION *is our* **BUSINESS**

More than 60 years ago we entered into a partnership of protection with American Industry.

Ours was the mission to guard against the hazards of Fire, Theft and Property Damage—resulting from accident or intent.

Acting on the truism that the way to avoid disaster is to *prevent* it, we developed and perfected the DETEX WATCHCLOCK SYSTEM, a tamper-proof method for controlling and recording the activities of watchmen.

Nor was this our only contribution. Almost singlehanded we pioneered for better standards in the selection, training and supervision of watchmen themselves.

Veterans in the fight against Industry's peacetime enemies, DETEX is ready to meet the grimmer challenge of America at War. Manufacturers engaged in vital defense production are drawing freely on our skill and experience. We will gladly consult with you regarding *your* protection problems.

Are you planning to expand your staff of Guards and Watchmen? Be sure to get a copy of our 32-page manual, "PLANT PROTECTION FOR NATIONAL DEFENSE". It contains important information.

DETEX WATCHCLOCK CORPORATION
84 Varick Street, New York
4163 Ravenswood Avenue, Chicago
31 Beach Street, Boston
122 Marietta Street, Atlanta

DETEX WATCHMENS CLOCKS

NEWMAN • ECO • ALERT • PATROL

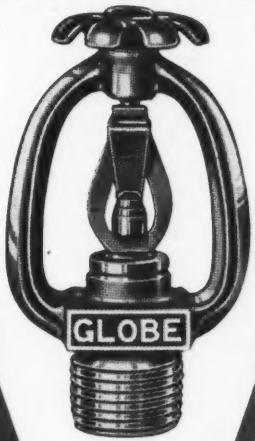
QUALITY BUYING IS NOW PATRIOTIC

BE PREPARED

GLOBE SAVEALL SPRINKLER

WILL PROTECT

ALWAYS ON THE "ALERT"



APPROVED BY ALL GOVERNMENT AND INSURANCE AUTHORITIES GLOBE DEVICES CONSERVE METALS, ARE MINIMUM SIZE AND WEIGHT AND GIVE

MAXIMUM PERFORMANCE

ETERNALLY

VIGILANT

QUALITY

FIRE DEFENSE IS A 24 HOUR A DAY JOB IN PLANTS SPEEDING UP PRODUCTION. TO ASSURE PROMPT UNINTERRUPTED FLOW OF ESSENTIAL

WAR MATERIALS

"THUMBS UP"

ASSURED

VICTORY

GLOBE AUTOMATIC SPRINKLER COMPANY

Sales and Engineering Offices in Principal Cities

SPRINGFIELD FIRE DELAYS GARANDS

Major Blaze in Arsenal to Defer Expansion in Rifle Plant

By The Associated Press

Springfield, Mass., Jan. 30.—A three-alarm fire caused major damage today to one of the new buildings at the Springfield Arsenal, home of the vital Garand automatic rifle, but the blaze was brought under control before it could spread to other structures in the reservation.

Several persons were overcome by smoke.

An estimate on damage to the building, which would have been a joint storage and assembly plant, awaited a survey by contractors on how newly poured concrete had withstood the blaze.

Army officials in Boston, on the basis of telephonic reports from Springfield, stated that there were no indications of sabotage.

The blaze started in a tarpaulin used during winter construction work and was discovered quickly by an armory guard. One Army officer said it appeared that a blow torch might have started the fire.

Let's stop such needless destruction. For a few cents more per yard, the canvas tarpaulins used in this construction job could have been made of FIRE CHIEF treated Duck — the permanent fire-resisting finish that won't wash out.

Thousands of dollars would have been saved.

Construction of this vitally-needed building would have been completed months sooner.

Wherever flammable canvas presents a hazard, indoors or out, from sabotage or carelessness, FIRE CHIEF treated Canvas assures safety.

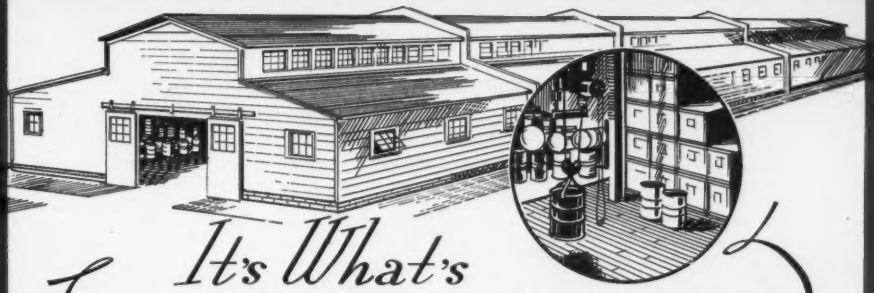
Approved by both the Underwriters Laboratories and the Associated Factory Mutual Fire Insurance Companies. Meets all Government requirements.

WM. E. HOOPER & SONS CO.

New York PHILADELPHIA Chicago

Mills: WOODBERRY, BALTIMORE, MD.

FIRE CHIEF *The Finish That WON'T WASH OUT*



It's What's INSIDE BUILDINGS THAT COUNTS

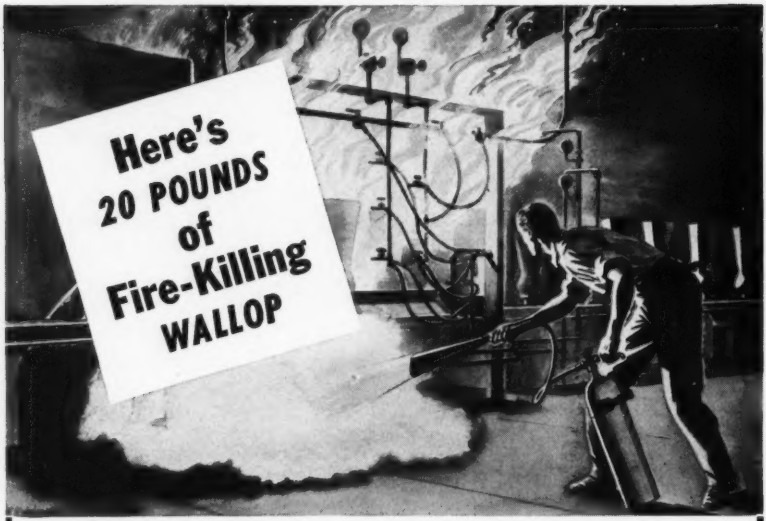
QUICKLY and inexpensively built, such temporary buildings as the one illustrated seem to belie the supreme importance which they actually represent today. Temporary, yes—but so is war—and, while it lasts, thousands of these buildings the country over are providing a vital link in the all-out prosecution of the war. For, the war activities inside such buildings—manufacture, storage, administration—make them all-important starting points in the rigidly scheduled supply lines to our far-flung battle fronts. Sprinkler these buildings and thus protect them fully from the most destructive enemy within our borders—FIRE. Don't let fire cause a reversal in military operations at some point of action.

The Suprotex Sprinkler System—for factories, warehouses and offices—sounds a fire alarm in advance of the opening of sprinklers . . . sounds a trouble alarm if it is tampered with or accidentally damaged . . . does not cause water damage when the system is damaged . . . and enables repairs to be made without shutting off the protection. The Suprotex-Deluge System of open sprinklers—for airplane hangars, munition plants, etc.—immediately throws a deluge of water on the fire and on adjacent materials . . . is ahead of the progress of fast spreading fires.

SUPROTEX:
The Rear Guard of Industry at War

"AUTOMATIC" SPRINKLER CORP. OF AMERICA

YOUNGSTOWN, OHIO • OFFICES IN PRINCIPAL CITIES



...FOR FLAMING LIQUIDS, ELECTRICAL FIRES

Different fires need different extinguishing methods. For example, we don't tell you to use LUX extinguishers on paper and rubbish fires. That's not their main job, although they often do it.

The real fire fighting job of LUX extinguishers is killing electrical and flammable liquid fires. These fires need *smothering*. LUX blankets them in a fast-expanding blizzard of carbon dioxide snow-and-gas, one of the fastest-known extinguishing agents.

The LUX twenty-pounder shown in the illustration carries a heavy punch against industry's toughest fires. If you're protecting flammable liquids or electrical equipment, here's your fire fighter. Its 20 lbs. of carbon dioxide give it ample hitting power to knock down blazes that baffle ordinary extinguishers. That's why it's industry's favorite among all LUX models!

LUX
SNUFFS OUT FIRE

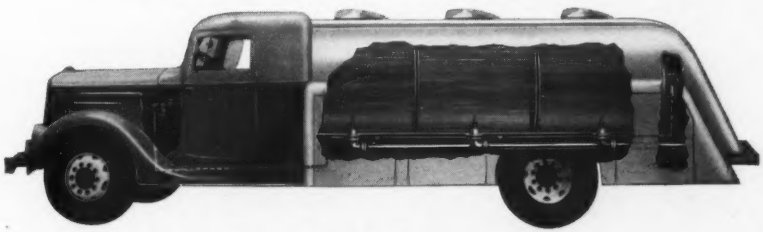
Walter Kidde & Company
Incorporated
437 West Street Bloomfield, N. J.

★ **This is one of a series of advertisements appearing in a list of industrial publications.** ★

MORE DANGEROUS than BOMBS

With our industrial and "target" areas bristling with anti-aircraft guns, we are very conscious of the danger from without. With gasoline such a common commodity, we are apt to be oblivious to the dangers from within. A gasoline tank truck, unprotected by S. & J. Hydraulic Internal Safety Valves, can be more dangerous on your city streets than explosive or incendiary bombs dropped from the sky. Right now, more than ever before, we cannot afford the disaster of avoidable fires. You can eliminate one fire hazard if you insist that all truck tanks under your jurisdiction are equipped with S. & J. Internal Safety Valves.

This is one of four different types of S. & J. Internal Safety Valves, available in sizes from 1½ to 6 inches.



SHAND & JURS CO.

BERKELEY, CALIFORNIA

NEW YORK CHICAGO HOUSTON LOS ANGELES

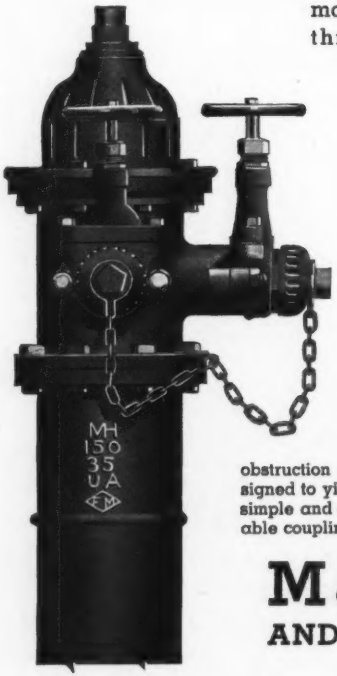
SHAND & JURS

Fire-Fighters Appreciate

VALVES
HYDRANTS

AND PIPE LINE ACCESSORIES

M & H products are well known for high quality material and expert workmanship. They have been widely used throughout the country for many years. They include several types of Gate Valves, Check Valves, Flap Valves, Valve Boxes, B & S Fittings, Flanged Fittings, Fire Hydrants and many other cast iron pipe line accessories.



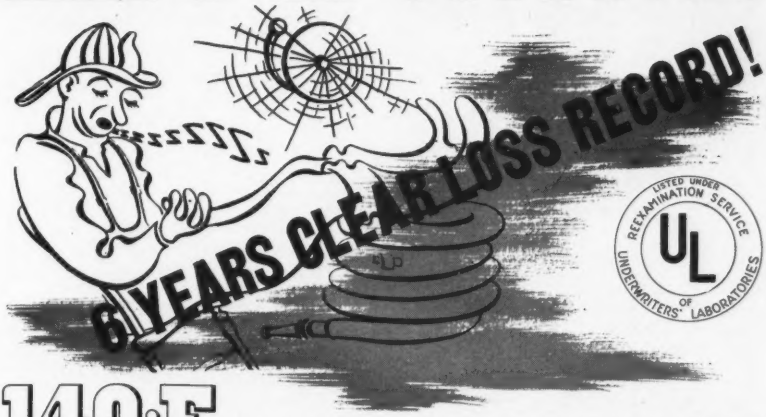
AWWA & UNDERWRITERS APPROVED FIRE HYDRANTS

M & H Fire Hydrants are dry top and revolving head. They are easy to lubricate. Maintenance costs are low due to simplicity of design and rugged construction. They have low friction loss and great efficiency because barrel diameter is not reduced and there are no working parts or obstruction in waterway. Special Traffic model is designed to yield at the ground line under impact. Repair is simple and easy by renewing breakable bolts and breakable coupling on stem.

M & H VALVE
AND FITTINGS COMPANY

ANNISTON, ALABAMA

COLD FACTS ABOUT 140·F SAFETY DRY CLEANING

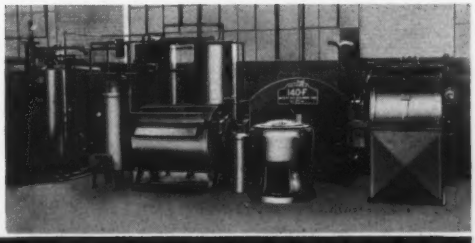


140·F IS A CLASS II UNIT THAT COMPLIES WITH STANDARDS OF N. B. F. U. PAMPHLET NO. 32

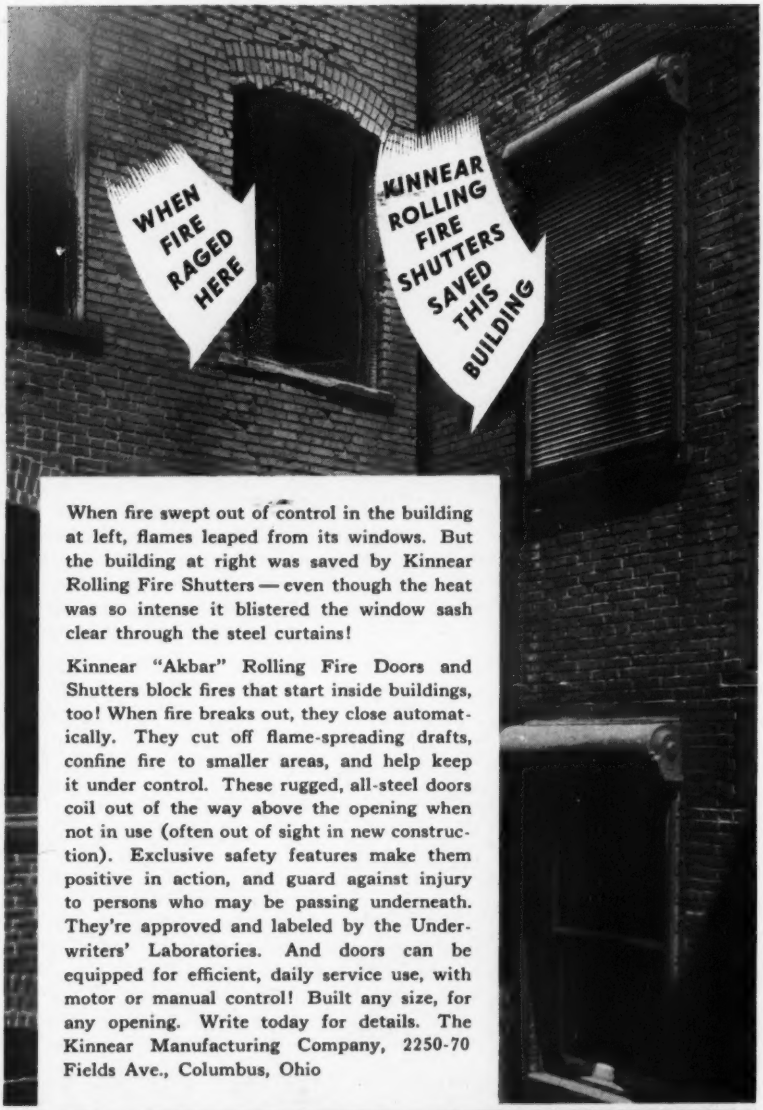
What's remarkable about that? Just this! The 140-F is NOT a chlorinated solvent dry cleaning unit. It's the original Safety Petroleum Solvent System — an exclusive development of the U. S. Hoffman Machinery Corporation. It has the operating advantages and economy features that dry cleaners want, yet it is an Approved System that has made a distinct contribution to safety in the dry cleaning industry.

USES 140° FLASH PETROLEUM SOLVENT

The Hoffman 140-F dry cleaning system employs safety petroleum solvent with flash point of approximately 140°F. It has many unusual features, including a drying tumbler from which all vapor is expelled at safe temperatures before tumbler can be opened.



U. S. HOFFMAN MACHINERY CORPORATION
105 Fourth Ave. • New York, N.Y.
EQUIPMENT FOR EVERY DEPARTMENT OF THE DRY CLEANING PLANT

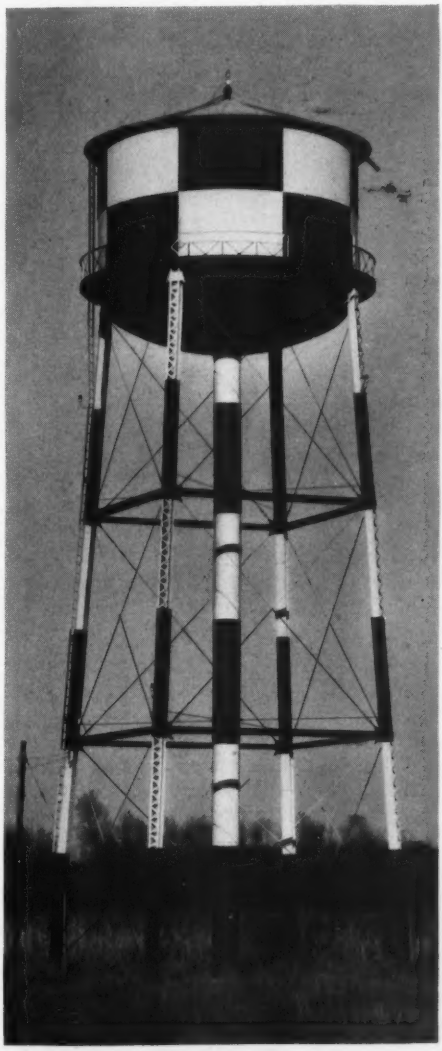


When fire swept out of control in the building at left, flames leaped from its windows. But the building at right was saved by Kinnear Rolling Fire Shutters — even though the heat was so intense it blistered the window sash clear through the steel curtains!

Kinnear "Akbar" Rolling Fire Doors and Shutters block fires that start inside buildings, too! When fire breaks out, they close automatically. They cut off flame-spreading drafts, confine fire to smaller areas, and help keep it under control. These rugged, all-steel doors coil out of the way above the opening when not in use (often out of sight in new construction). Exclusive safety features make them positive in action, and guard against injury to persons who may be passing underneath. They're approved and labeled by the Underwriters' Laboratories. And doors can be equipped for efficient, daily service use, with motor or manual control! Built any size, for any opening. Write today for details. The Kinnear Manufacturing Company, 2250-70 Fields Ave., Columbus, Ohio

SAVING WAYS IN DOORWAYS

KINNEAR ROLLING DOORS



FIRE PROTECTION for a new INDUSTRIAL PLANT

At first glance you might think that this 100,000 gal. elevated tank is located at an army camp or flying field. Actually it provides gravity water pressure for the automatic sprinkler system in a new industrial plant near an air route, hence the painting for visibility from the air.

For obvious reasons, this view was made looking away from the buildings. At the photographer's back was a modern plant, humming with activity. Day and night the supply of water in the tank guards that plant against fire so that production will go on. Whenever a fire breaks out, the flames will quickly open a sprinkler head and be quenched by water from the tank before they gain headway.

If you have a sprinkler system at your plant, be sure that it is in working order at all times.

CHICAGO BRIDGE & IRON COMPANY

CLEVELAND CHICAGO BIRMINGHAM NEW YORK
WASHINGTON HAVANA GREENVILLE PHILADELPHIA
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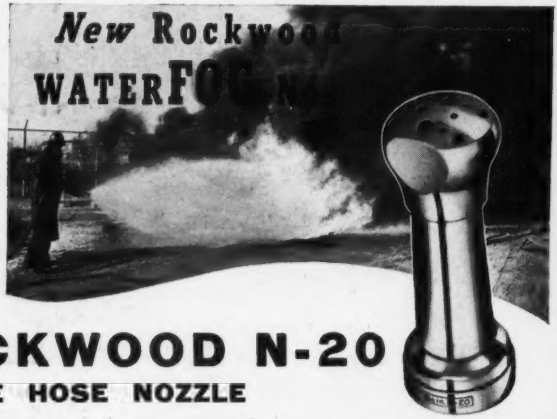
FIGHT Incendiary Bomb

Flammable Liquid and Electrical Fires

with



The ROCKWOOD N-20
FIRE HOSE NOZZLE

This practical new nozzle was developed to *safely* combat three dangerous hazards — incendiary bombs, flammable liquid and high voltage electrical equipment fires.

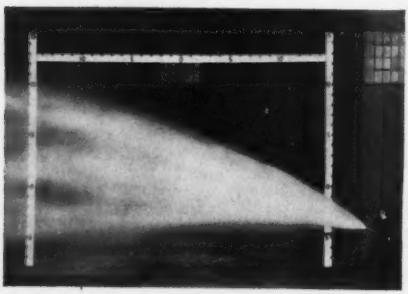
The Rockwood N-20 projects a large dense pattern of *low* velocity WaterFOG far greater distances than heretofore have been possible because an exclusive Rockwood method of generating and propelling Fog, known as the *Internal Impingement* principle, is used.

The long range and extremely low conductivity of the WaterFOG it discharges make the Rockwood Type N-20 a nozzle which can be used with safety in fighting fires in oil filled transformers and other electrical equipment carrying high voltage.

WaterFOG puts out in a few seconds burning oil and phosphorous types of incendiary bombs. Using the N-20 Nozzle from a safe distance, firemen can render harmless the dangerous thermit-magnesium bombs—by safely accelerating their consumption and thoroughly cooling and wetting down the surroundings.

The Rockwood Type N-20 comes in four sizes to fit existing hose lines: ¾", 1", 1½" and 2½".

Write for new literature.



ROCKWOOD SPRINKLER COMPANY

56 HARLOW ST., WORCESTER, MASS.

For 36 years Specialists in the Engineering, Manufacture and Installation of Fire Protection Equipment.

In Canada: Worcester-Rockwood, Ltd., Montreal and Toronto.

Protect Industry

PROPERTY CREATED BY YEARS OF INDUSTRY IS DESTROYED BY FIRE IN AN HOUR as the result of only a slight delay in sending an alarm.

Three-Fold
Fire Alarm Box

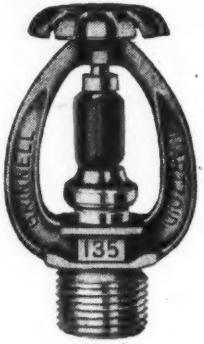
Fire is the greatest destroyer of property, and DELAY due to inadequate facilities for transmitting alarms to the fire department is the greatest accelerator of the flames.

A reliable Fire Alarm Telegraph System with adequate box distribution protects property, gives the fire department a chance to keep losses small, and relieves the community as a whole from the responsibility for fire waste due to DELAYED ALARMS.

Surveys, plans, and estimates furnished without cost or obligation.

THE GAMEWELL COMPANY

Newton Upper Falls, Massachusetts



PRODUCTION

Today's overloaded production schedules call for greater concentrations of personnel and equipment — stocks of highly inflammable materials — warehouses filled with raw or finished supplies. Speed, carelessness, possibilities of sabotage . . . all drastically increase the danger of fire.

Regardless of increased hazards, due to war production in many Plants, there is one sure way to eliminate for all time the possibilities of their destruction by fire. And that way is to install a Grinnell Automatic Sprinkler System. On silent duty, day and night, year after year, it will stand guard to stop a fire at its source.

There is a type of Grinnell Sprinkler System for every fire hazard. Each is designed to provide the utmost in automatic fire protection for specific conditions. Complete information is available for the asking from any of our offices throughout the country. Grinnell Company, Inc., Executive Offices, Providence, R. I.

GRINNELL

AUTOMATIC SPRINKLER FIRE PROTECTION